PUBLICATION OFFICES:

168–177 POTTER BUILDING, NEW YORK.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

W. J. JOHNSTON, Editor and Publisher.

T. COMMERFORD MARTIN, JOSEPH WETZLER. } Associate Editors.
G. H. STOCKBRIDGE, Assoc. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 48 Congress Street, Boston.
W. I. BARKER, Manager.

Western Office, 44 Lakeside Building, Chicago.
W. A. KREIDLER, Manager

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.

(Postage Prepaid in the U. S. or Canada.)

CLUBS.—In clubs of 4 or more, $2.50 a year each; with a free extra copy to the getter-up of a club of 8. Subscription to foreign countries, $4 a year.

In requesting your address changed, give **old** as well as new address.

THE ELECTRICAL WORLD HAS THE LARGEST CIRCULATION

OF ANY ELECTRICAL JOURNAL PUBLISHED, AND IS

THE BEST ADVERTISING MEDIUM.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished on application covering these points. Notices of Situations or Help Wanted, $1 to $2 an issue.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News**, or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

Matter for the **Editorial** Department should be addressed to

The Editor of The Electrical World, New York.

Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to

W. J. JOHNSTON, Publisher,
Potter Building, New York.
OR EITHER OF THE BRANCH OFFICES.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE.

The Fort Wayne Jenney Station at Peoria, Ill. 89
The Field Electric Street Railway System. 90
The Packard Vacuum Pump 91
Automatic Cut Out for Electric Gas Lighting Circuits. 91
Diehl's Gramme Armature. 92
Werner Siemens..... 92
Safety Circuit, for Electric Lighting 92
The Practical Requirements of Small Motors 93
An Electric Light Radiator. 95
Electric Light Hoods 95

NEW BOOKS:

"Les Telephones Usuels."... 88

CORRESPONDENCE:

Electricity Generated by Steam Jets..... 91

EDITORIAL PARAGRAPHS..... 87

MISCELLANEOUS:

The Philadelphia Meeting of The National Electric Light Association..... 88

MISCELLANEOUS: PAGE.

The Edison Convention at Rochester..... 89
The Polarization of Resistance Coils..... 89
New York Subway Legislation..... 90
Walker's Sulphur Sal-Ammoniac Battery..... 91
Hall's Phenomenon in Gases 92

DEPARTMENTS:

New York Notes..... 96
New England Notes..... 96
Philadelphia Notes..... 96
Western Notes 96
The Telegraph. 97
The Telephone 97
The Electric Light 97
Applications of Power..... 97
Personals 97
Stock Quotations 97
Miscellaneous Notes..... 98
Business Notices..... 98
Our Illustrated Record of Electrical Patents..... 98

New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

PAGE

Seth W. Fuller & Holtzer—The "Climax" Wooden-Box Bell.. .. ix
Giles Bro. & Co.—Anti Magnetic Shields xi
Norman Hubbard—The Packard Vacuum Pump..... xi
Ball Engine Co.—Automatic Cut-off Engine..... xi
J. Hoare & Co.—Electric Light Radiator xi
The United States Electrical Co.—Specialties in Electric Apparatus and Supplies xii
The Excelsior Electric Co.—Automatic Regulating Machines and Lamps xiv
E. S. Greeley & Co.—Electrical Supplies..... xviii
The Electrical Supply Co.—Switch-Boards, Carbons, etc..... xviii
The Billings & Spencer Co.—Drop Forgings..... xix
Ryder & Co.—Envelope Moistener xix
Novelty Electric Co.—Burglar Alarms, Annunciators, etc... xix
Olson Oil Co.—Oil Filters..... xix
Woodward & Rogers—Tapping Machines..... xix
Sturges & Blum Electric Manufacturing Co.—Zincs and Coppers. xix
Parker, Stearns & Sutton—Rubber Tube Tape. xix
The Cincinnati Electrical Co.—Gelatine Battery..... xix
James H. Seymour—The Clark Dynamo xx
Harrisburg Car Manufacturing Co.—The Ide Engine..... xx
Van Depoele Electric Manufacturing Co.—Motors and Electric Railway Equipment..... xxv
N. P. Bowsher—Bowsher's Tell Speed Indicator..... xxvii
Want and For Sale..... xvii

Vol. IX. NEW YORK, FEB. 19, 1887. No. 8.

LAST WEEK, it will be remembered, the demands on our space compelled us to print 40 pages. This week our issue consists of no less than 44 pages, every one of which, from cover to cover, has something that deserves notice and consideration. Although the size of the number and of the edition compels us to go to press very early in the week, we have nevertheless succeeded in giving a full account of the opening of the convention of the National Electric Light Association at Philadelphia, on Tuesday.

ABOUT two and a half years ago, an electrical conference was held in Philadelphia, and the proceedings were of more than ordinary importance. Once more Philadelphia is the scene of an electrical gathering, and it is safe to say that the deliberations and discussions of the present week in the meeting of the National Electric Light Association have been as valuable as those of the National Conference of Electricians. In fact, it might be said that the Electric Light Association has largely taken upon itself to reduce the theories of the Conference to practice, and that its members have shown themselves remarkably apt and able in this respect. From what we mention on another page of the week's programme, it will be readily seen that the work of electric lighting is not yet so far settled as to exclude theory. The truth is, the development of electric lighting will be found to carry us all into new fields, and just what those fields are and just what should be the means of entering and occupying them must for a long time to come be matter of theory and conjecture.

WE are in receipt of a special cable dispatch from London announcing that in the suit of the Edison-Swan Company against Woodhouse & Rawson, the Court of Appeals, before which the case was carried, after a decision in favor of the Edison-Swan Company in the lower courts, has now rendered a decision confirming that below, upholding the validity of the Cheesebrough patent.

THE true cause of the polarization of resistance coils seems still to be doubtful in the minds of some. Prof. Thomas pointed out recently that he found the effect to be due to electrolytic action arising from the presence of moisture in the coils. An article appears in another column from one who has experimentally observed the action and who finds that in his case this explanation does not apply. As the results of tests may be changed by the action noted, it is desirable that further attention be given to the phenomenon.

ARGUMENT in the telephone appeals before the United States Supreme Court has now ceased, but it will probably be months before any decision is reached. The recent proceedings have been remarkable principally for revival of interest in the Drawbaugh claims, which have benefited by an extremely able presentation of their strongest points. The judges have evidently given the case their closest attention, realising the importance and magnitude of what is at stake. Those interested in the Bell patents now await the decision of the court in confidence, the quotation of the stock being a pretty good present indication of their feelings.

THERE is talk of another telegraph company to operate between the eastern seaboard and Chicago. It will be interesting to know what the company intends to do and how it hopes to earn a profit. The field is tolerably well occupied at present, and the rates are quite as low as they need be. With the control of special lines of business, however, and the use of improved apparatus or methods, the new system might pay its way. The most hopeful field for telegraphic development just now, it seems to us, lies in the railway induction telegraph, which is destined to come into very general use.

SUCH is the tangle and trouble in the work of putting the wires of this city underground, that only new legislation can bring matters into good shape and enable the Commission to carry out its plans. In fact, all sorts of proposals are now before the Legislature, but the bill we print is that which the Commission favors, as putting it in the position it desires to occupy. Meantime, the companies that wish to take part in underground operations but have not so far enjoyed any patronage from the Commission, are seeking to make the most of the opportunity thus presented, and will now do their best to be insured a share of the work. Altogether it is a "state of things" that will serve as a lesson to other communities modeling after New York.

THE entirely new departure taken by Mr. S. D. Field in the design for an electric street railway must attract attention from the many interesting mechanical, as well as electrical, points it possesses. It will be noted that two conduits serve to carry the same number of conductors charged to an opposite potential with a generator at each end, so that each conductor is an independent source of power for the motor. In this way a defect in one conductor causes no interruption of traffic, as the other is still available. This constitutes a decided advantage, and makes the system entirely independent. As regards the mechanical construction, it will be noted that the tops of the conduits form the rail bearings and the wheels possess central flanges which run in the slots. Taken as a whole there are many features of novelty in the plan, and we hope soon to see Mr. Field's method put to practical test.

MR. S. S. WHEELER, in his paper appearing on another page, makes a true assertion when he states that heretofore small electric motors have not been designed according to the experience gained with the larger ones, and that this is the cause of their diminished efficiency. Although this may appear axiomatic, it nevertheless deserves to be pointed out, as the fact seems to have been overlooked by many. The little motor described by Mr. Wheeler presents several points of novelty, more particularly in the armature construction. The use of flat wire wound edgewise permits of an increased number of convolutions on the core, as no waste space remains between contiguous turns. As Mr. Wheeler points out, it is not entirely possible, nor is it, under given conditions, desirable, to attain the same efficiency in small motors as in the large ones; but we ought to try, and it is possible, to approach this limit very nearly. With the small moter so improved the use of the primary battery, where its use is unavoidable, will not be looked upon with such disfavor as heretofore, for with a motor of increased efficiency the power used will cost correspondingly less.

IT is perhaps something in the nature of a coincidence that we make reference this week to some of the scientific speculations of Werner Siemens, and that a Washington correspondent should, at the same time, in a letter in the New York *World*, credit Mr. Edison with being busy on a similar idea—the production of food from "dirt and water." Of course, in the one case as in the other, there is some foundation for the reports, but Mr. Edison has so often been the hero and victim of the wildest canards that it is safe to say he is not guilty of the yarns put in his mouth by the imaginative correspondent, who, possibly, has been helped by the perusal of some account of what Mr. Edison's distinguished German contemporary has been thinking and saying. It has always struck us, too, that Mr. Edison was never happier than when playfully misleading the innocent newspaper scribe. He is not yet so sick a man that he cannot enjoy a quiet little practical joke. We may mention, by the way, as interesting, that our own editorial and illustrated articles on Werner Siemens have been ready about three weeks waiting to get into our crowded columns. This being the case, it is evident that there has been time enough to get up the sensation in the way we suggest.

ONE of the most notable men of the times is Werner Siemens, who stands among the pioneers in the practical application of electricity. Having arrived at the age of maturity when the electric telegraph became an established fact, he seized upon this as a starting point in a study and practice which finally led to the discovery of the dynamo-electric principle. This achievement alone would have made his fame a universal one, but Siemens still thinks and works in the direction of progress. Thus a few years ago he put forth the suggestion that in future time, when our main supply of fuel, coal, would be exhausted, electricity, in connection with chemistry, would be enabled to utilize the existing forces in nature for the production of portable fuel, and by this means extend the limits of the existence of the race. He went even further, and asserted that in the future, food products would be artificially prepared from the existing elements. This assertion has recently raised considerable discussion among the German political economists who have set it down as the fanciful effort of pure imagination, without a single foundation in fact, and hence as misleading and mischievous. Siemens, therefore, feels called upon to justify his assertions, and to repel the accusation of being a dreamer. As regards the portable fuel question, he states that hydrogen can be generated by the decomposition of water through the medium of electricity, and by utilizing natural forces as the motive power. True, the gaseous form of fuel is not the one best adapted for transportation, but Siemens suggests that common salt or other fusible salts can be acted upon by the electric current so as to produce solid sodium, potassium, magnesium, calcium, etc., which can then be employed as combustible material. The question of the supply of food products, he admits, is a more formidable one, although food may also be looked upon as a kind of combustible material. But we must add to the combustible substance the material required to sustain and renew the nitrogenous constituents of the human organism. This part of the question may be solved by the aid of ozone—produced by electricity—which has the well known characteristic of combining with the nitrogen of the atmosphere. Hence we have here a method which future discovery may apply to the manufacture of nitrogenous food products, making us independent of the natural nitrogenous foods. These methods, which Siemens allows to be no more than hypotheses, are, nevertheless, far from visionary, and thus he merely places himself on record for events which may be many centuries hence, enjoying, meantime, a bottle and a bird, and a good coal fire, like the majority of us.

Philadelphia Meeting of the National Electric Light Association.

(From Our Special Correspondent.)

PHILADELPHIA, Feb. 16.

The convention of electric light men now in progress here promises to be one of the most memorable of its kind ever held in America. The largeness of the attendance is even at this early stage remarkable, and it looks as though, before we finish, the present roster will be more than doubled. The Hotel Lafayette, which has been constituted the headquarters, is just brimming over with electricians and others interested in the business, and what with the exhibits of lamps, motors, distributors, cables, wires, globes, reflectors, etc., might well be taken for an electrical exhibition. Speaking of exhibitions reminds one of the fact that no such gathering of electrical people and of electrical apparatus has been seen here since 1884, when the Franklin Institute so enhanced its reputation by holding the great International Electrical Exhibition of that year. The fact is, staid and sober old Philadelphia has been in the throes of excitement all day long, but it would not be just to ascribe all the hub bub in the city to the convention, one explanation being that the election for mayor has been going on.

Owing to the limitation of space in the Lafayette, the meetings are held outside its walls and in the Union League Club. I rather think our popular president, who is prominently connected with the Crescent Club of Baltimore, quite enjoyed the humor of the situation, on finding himself presiding in the very home of Republicanism. Still, he seemed to have very little difficulty in harmonizing with his environment, and wielded his "bung starter" with his usual promptness, good sense and ruthless contempt for mere oratorical flights.

Shortly after noon the Convention was called to order by President J. F. Morrison, who, in an able address, showed that the organization had grown considerably since the last convention, not only in members and influence, but also in financial strength. There are at present 159 members belonging to the association.

The President then introduced Mr. Thomas Dolan, of Philadelphia, Superintendent of the U. S. Mint, who in turn introduced Col. A. N. Snowden. The latter welcomed the convention to the city of Philadelphia in a very happy manner.

The roll of members was then taken. Mr. Arthur Steuart then read the report of the Legal Committee, which set forth the work accomplished and that intended for the future. After some discussion, the report was adopted.

The report of the Committee on Standard Gauge was then read by Dr. A. V. Garratt. It was an exhaustive account of the valuable labors of the committee, who had weighed all the evidence in favor of and against the gauges in present use, and finally offered the metric as the best gauge, whose numbers were from No. 1 to No. 100, each number representing a wire of corresponding number of lengths of millimetres in diameter. Thus, No. 1 is intended to represent a wire $\frac{1}{10}$ millimetre in diameter; No 50 of a wire 5 millimetres, and No. 100 a wire of 10 millimetres in diameter and equal to about a No. 0000 B. and S. gauge. After a lively discussion and the reading of a number of letters from manufacturers and users of wire, the report was adopted and the committee continued, some new members being added thereto, for the purpose of fully carrying out the work and calculating the resistance, weight, etc., of wires of the gauge proposed. The committee will report at the next convention.

Mr. C. C. Haskins then read a paper on "High Insulation," in which, with much humor and force, he showed that many electric light wires were the reverse of insulated when soaked with rain, and he advocated higher insulation and a rigid test.

The discussion brought out similar views. The Convention then adjourned until four o'clock.

On reassembling, the discussion of Mr. Haskins' paper was taken up, and it brought out several interesting points.

Prof. Houston claimed that the wires were when underground required to be easy of inspection, and he strongly preferred a large subway, which it should be the duty of the various cities to construct and rent to users.

Mr. Weeks then read a paper entitled "Popular Prejudice Against Electric Light Wires," which gave a good and forcible account of some of the absurd ideas prevalent regarding the subject of electric currents. The discussion brought out the relation of the insurance companies to electric lighting and the secretary read a pamphlet prepared by Mr. S. E. Barton for the New England Insurance Exchange relating to the subject. The pamphlet showed that when properly inspected, electric lighting plants are considered by the insurance companies the safest of all means of illumination.

During the session letters of invitation were read from Dr. W. H. Wahl, secretary of the Franklin Institute, extending the courtesies of that institution to the members for the stated meeting to-night (Wednesday), at 8 o'clock. The Julien storage battery and the Zipernowski-Deri system of secondary generators will be shown in operation.

Mr. A. J. DeCamp also invited the members to inspect the Brush station. The Convention adjourned to meet again at 10:30 A. M. to-day.

The programme for the work that remains is as follows:

SECOND DAY.

"Electric Motors."—F. J. Sprague, New York; Wm. Baxter, Jr., Baltimore; Prof. Edgerton, Philadelphia.

"Transmission of Power by Means of Belting."—H. J. Shay, Chicago.

"Plans for Electric Light and Power Stations."—S. A. Duncan, Pittsburgh; F. A. Upton, Boston.

"Underground Wires."—G. L. Wiley, New York.

"Incandescent Lighting from High Potential Circuits."—Joseph Wetzler, New York.

"Distribution of Electrical Energy by Means of Secondary Generators."—Dr. O. A. Moses, New York.

"Electrical Education."—Dr. Duncan, Johns Hopkins University, Baltimore.

I give below a list of names of those in attendance, so far as obtainable at this time:

J. F. Kelly, New York.
J. Wetzler, New York.
C. E. Stump, New York.
J. F. Morrison, Baltimore.
R. W. Pope, New York.
G. M. Phelps, Jr., New York.
E. Gennert, New York.
A. F. Upton, Boston.
W. M. Garver, Philadelphia.
W. L. Candee, New York.
H. McL. Harding, Boston.
A. Steuart, Baltimore.
F. Harrington, Chicago.
G. L. Beetle, Chicago.
F. Stewart, Chicago.
A. L. Ide, Springfield, Ill.
G. L. Wiley, New York.
Carl Hering, Philadelphia.
J. Chester Wilson, Philadelphia.
H. L. Barclay, New York.
W. M. Bond, Providence.
H. A. Rehan, Pittsburgh.
W. Baxter, Jr., Baltimore.
C. P. Curtiss, Cleveland.
F. A. Mason, Bridgeport.
B. Rhodes, Niagara Falls.
J. Anderson, Binghamton.
J. P. Crouse, Cleveland.
F. E. Kinsman, New York.
H. H. Eustis, Boston.
D. H. Smith, Jamestown, N. Y.
E. R. Weeks, Kansas City.
H. M. Linnell, Hartford.
H. Sprang, New York.
W. Baxter, Baltimore.
F. B. Pettingill, Cleveland.
H. Hall, New York.
E. F. Phillips, Providence.
F. A. Gilbert, New Haven.
J. Gilbert, New Haven.
H. D. Stanley, Bridgeport.
E. F. Peck, Brooklyn.
W. M. Callender, New York.
H. B. Cram, Boston.
L. H. Weissleder, Cincinnati.
M. M. M. Slattery, Woburn, Mass.
Frederick Swift, Woburn, Mass.
G. F. Porter, Pittsburgh, Pa.
Gardiner C. Sims, Providence, R. I.
A. J. De Camp, Philadelphia.
Prof. E. J. Houston, Philadelphia.
C. E. Bibber, Boston.
C. W. Holtzer, Boston.
H. M. Daggett, Jr., Attleboro, Mass.
J. P. Ford, New York.
P. H. Richardson, Philadelphia.
L. Schlegelmilch, Boston.
Dr. Otto Moses, New York.
E. T. Lynch, Jr., New York.
T. C. Martin, New York.
W. I. Barker, Boston.
T. McCoubray, Jr., Baltimore.
C. W. Price, New York.
G. Worthington, New York.
C. C. Haskins, Chicago.
A. V. Garratt, Boston.
J. H. Shay, Chicago.
W. A. Lawrence, Cleveland,
C. D. Smith, Cleveland.
H. A. Fuller, Philadelphia.
R. M. Ross, Boston.
J. A. Pentz, Philadelphia.
J. A. Powers, Troy, N. Y.
B. L. Mitchell, Taunton, Mass.
R. W. Ryan, New York.
F. Ridlon, Boston.
F. C. Royce, Washington.
H. C. Davis, New York.
W. E. Sharpe, Philadelphia.
N. H. Edgerton, Philadelphia.
W. R. Kimball, Woburn, Mass.
C. L. Wright, Cleveland.
Wm. Hubbard, Elgin, Ill.
Geo. T. Manson, New York.
M. J. Wightman, Hartford.
C. O. Richardson, Jr., East Cambridge.
A. W. Butterworth, New York.
H. P. Hungerford, New York.
J. Latshaw, Pittsburgh.
W. D. Sargent, Brooklyn.
A. S. Hibbard, New York.
J. B. Crouse, Cleveland.
C. R. Truex, New York.
H. L. Bancroft, Bridgeport.
F. J. Sprague, New York.
H. W. Pope, Elizabeth.
H. L. Lufkin, New York.
C. W. Gould, New York.
W. C. Kerr, New York.
S. Holbrook, Philadelphia.
W. J. Buckley, Chicago.
C. Selden, Baltimore.
W. F. Brewster, Boston.
M. D. Law, Philadelphia.
R. T. McDonald, Fort Wayne, Ind.
A. F. Moore, Philadelphia.

NEW BOOKS.

LES TÉLÉPHONES USUELS. By Charles Mourlon. Second edition. J. Lebègue & Co., Brussels. 1887. 6 × 9 inches, 324 pp. Price, 5 fr.

The first edition of this work, which appeared in 1883, was a comparatively small volume, but, keeping abreast of the times, the author has gathered new material and has presented it in an interesting manner. As in the first edition, he leaves aside all questions of a scientific or theoretical nature, confining himself entirely to the practical side of the question of the application of the telephone. A large number of different apparatuses and accessories are described, including central office equipment, and a good insight is afforded, especially as regards European practice.

Lincoln and the Gettysburg Telegram.

For unconventionality nothing can exceed or even come up to the manner in which Lincoln received the telegram announcing the victory at Gettysburg. The story has just been told by Mr. Augustus Brandegee, who had it from the lips of Secretary Stanton, and it runs thus:

Mr. Lincoln had been excessively solicitous about the result of that battle. It was known that Lee had crossed into Pennsylvania, threatened Washington, and that battle had been joined near Gettysburg, upon which in all probability the fate of Washington and the issue of the war depended. The telegraphic wires ran into the War Department, and dispatches had been received of the results of the first day's fight, which showed how desperate was the attack, the stubbornness of the defense, and that the result was indecisive. All that day and the next Mr. Lincoln was in an agony of anxiety; running over, as was his wont, to the War Office to ascertain for himself the latest news, instead of waiting for the reports to be sent him by his subordinates. Then came a long interval when nothing was heard from Meade, and the President was wrought up to an intense pitch of excitement. Night came on, and Stanton, seeing the President worn out with care and anxiety, persuaded him to return to the White House, promising if anything came over the wires during the night to give him immediate information. At last, toward midnight, came the electric flash of that great victory which saved the Union.

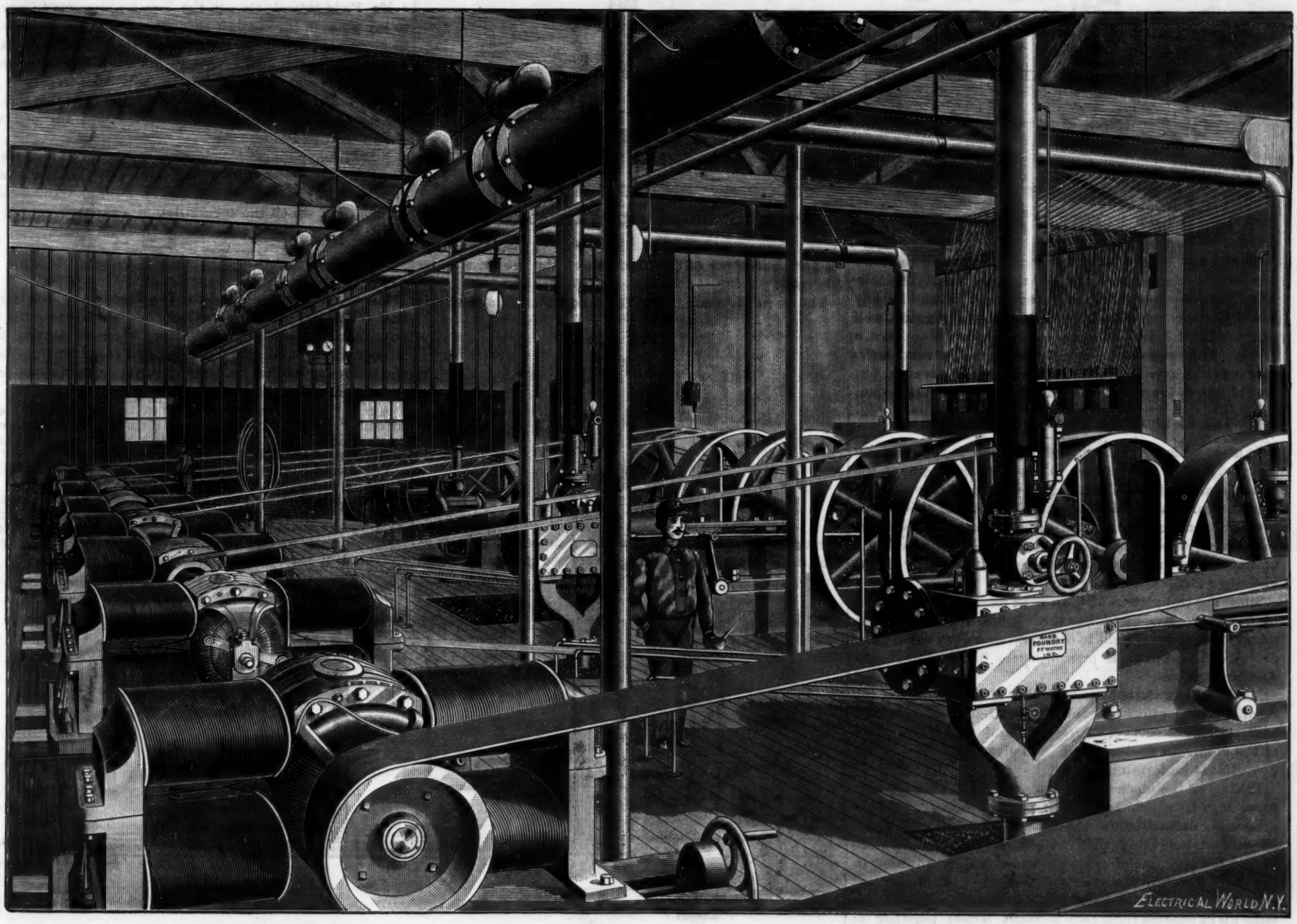
Stanton seized the dispatch and ran as fast as he could to the Executive Mansion, up the stairs and knocked at the room where the President was catching a fitful slumber. "Who is there?" he heard in the voice of Mr. Lincoln. "Stanton." The door was opened and Mr. Lincoln appeared with a light in his hand peering through the crack of the door, "in the shortest nightdress and longest legs," as Stanton said, he ever saw on a human being. Before Stanton, who was out of breath, could say a word, the President, who had caught with unerring instinct the expression of his face, gave a shout of exultation, grabbed him with both arms around the waist and danced him around the chamber until they were both exhausted. They then sat down upon a trunk and the President, who was still in his nightdress, read over and over again the telegram and then discussed with him the probabilities of the future and the results of the victory until the day dawned.

A Drawback to Newspaper Work.—"Newspaper work in the Far West is attended with many drawbacks," says the city editor of a Cheyenne paper. "I remember one instance in particular which may serve to show you what we have to contend with. About two weeks ago the operator in our office began to receive what promised to be a sensational murder from somewhere near Rawlins. There was 'wire trouble' all along the line, and the night editor, who was standing over the operator, was beginning to fear that the 'matter' would not be in time for his edition. The instrument worked laboriously, the operator had reached that point where the murderer had pointed the smoking pistol to his own breast, when—snap. 'Wire's gone,' exclaimed the operator, with a long breath. 'Might just as well shut up shop and go home, for we can't get it again to-night.' The dispatch, amplified and embellished, was printed with a scare head. About noon the next day it was found that a tree to which the wire was attached had been been borne down by snow."—*Chicago Herald.*

The Fort Wayne Jenney Station at Peoria, Ill.

We illustrate on this page the fine plant at Peoria, Ill., owned and operated by the Jenney Electric Light and Power Company, of that city.

The company was organized in the fall of 1883, and started with a plant in November of that year of about eighty lights. In the spring of 1885 it was awarded the city contract, since which time the streets have been lighted by electric light exclusively. The plant consists to-day of twelve 30-light dynamos and eight 16-light dynamos. About 210 lamps are used for street lighting and the others for commercial work. The steam plant consists of six 60″ × 16′ boilers with Jarvis setting, two 300 h. p. Turner condensers, manufactured by the Bass Foundry and Machine Works, Fort Wayne, Ind.; 300 h. p. Dean steam pumps; six 12 × 16, 80 h. p. Bass engines; three 9½ × 12, 60 h. p. Armington & Sims; one 10 × 12 60 h. p. New York Safety Steam. Machines and engines are all on the main floor of the building, and the belting is done direct from engines to dynamos. The company is now taking steps to introduce a plant of incandescent electric lights, and has already placed its order with the Fort Wayne Jenney Electric Light Company for one thousand 16 c. p. incandescent lamps and the necessary dynamos, etc., to operate the lights. In lighting the city the company uses thirteen Star iron towers 125 ft. high, five lights on each, and the other lights are suspended on O'Beirne mast-arms at the intersection of streets—a few being on 50 foot poles.



THE FORT WAYNE JENNEY ELECTRIC LIGHT STATION, PEORIA, ILL.

The Edison Convention at Rochester.

The third convention of the Association of Edison Electric Illuminating Companies met at Powers Hotel, Rochester, N. Y., on Feb. 9, and extended over two days. All the prominent companies were represented, and the papers read and discussions were largely given to central station management, the spread of the Edison light, and the practical questions met with in incandescent lighting by the Edison system. The statistics presented showed the rapid increase in the Edison business and brought out the fact that within the last sixty days ten new central stations aggregating 40,000 lamps had been undertaken.

The question of the distribution of power from central station also occupied the attention of the association, Mr. F. J. Sprague taking a prominent part in the discussion, and exhibiting his motor.

The meeting closed with a banquet tendered the association by the citizens of Rochester, and at which the Mayor and a number of prominent citizens were present. Among those who attended the meeting were the following:

John J. Beggs, President of the association and general manager of the Edison Company of Harrisburg, Pa.; J. H. Vail, secretary of the association and general superintendent and chief engineer of the Edison Electric Light Company, New York City; Charles Batchelor, general manager of the Edison Machine Works; W. J. Hammer, manager of the Edison Illuminating Company of Boston, Mass.; C. E. Chinnock, general superintendent of the Edison Illuminating Company of New York City; J. R. McLaughlin, secretary and manager of the Edison Illuminating Company of Detroit, Mich.; J. L. Judson, president, and H. L. Brewster, secretary, of the Edison Illuminating Company of Rochester; J. L. Barclay, vice-president of the Edison Illuminating Company of Oskaloosa, Ia.; H. K. Wood, president of the Edison Illuminating Company of Piqua, O.; E. H. Brooks, manager of the Edison Illuminating Company of Lebanon, Pa.; W. T. Mattram, superintendent of the Edison Illuminating Company of Wilmington, Del.; W. M. Brock, manager of the Edison Illuminating Company of Lawrence, Mass.; George A. Jessup, secretary and treasurer, and William B. Rockwell, superintendent, of the Edison Illuminating Company of Scranton, Pa.; George F. Sherwood, superintendent, and Charles W. Fowler, secretary of the Edison Illuminating Company of Jackson, Mich.; G. C. Sims, of the Armington & Sims Engine Company; H. M. Doubleday of the Edison Illuminating Company of Altoona, Pa.; H. McL. Harding, manager of the Sprague Electric Railway and Motor Company, New York; G. Hess, president, and P. B. Shaw, manager, of the Edison Illuminating Company of Williamsport, Pa.; Luther Stieringer, expert, Edison Electric Light Company, New York; A. F. Upton and W. F. Glazier of the Edison Illuminating Company of New Bedford, Mass.; John W. Howell, electrician of the Edison Lamp Company; J. Fujioka and S. Yashima of Tokio; J. Lindsay of the Imperial palace of the Mikado, Tokio, Japan.

Brooklyn, L. I.—An Edison company is being organized for Brooklyn on a broad basis. It will be very strong financially, one gentleman being willing to put $100,000 in, and the prospects of good business from the start are excellent.

The Polarization of Resistance Coils.

BY R. H. E.

In THE ELECTRICAL WORLD of Jan. 22, there appears an article on the "Polarization of Resistance Coils," advancing theories for the cause.

Since reading the article I have become sufficiently interested in the matter to conduct several experiments to satisfy myself of the truth of the statements made therein, and in doing so noted, what appeared to me, some strange phenomena.

I told several electricians the result of my experiments and asked their opinions, which varied widely; one, more prominent than any of the others, said that the alleged polarization was nothing more nor less than a static charge. I have reason, however, to believe differently.

In conducting the experiments referred to the instruments used were a Thomson astatic reflecting galvanometer, an Elliott 10,000 ohm resistance box, with bridge, a Sabine key and two cells of bluestone battery of the sawdust type. The Sabine discharge key, so well known among electricians in general, is made to operate two circuits, and so arranged that both circuits may be kept open at the same time. The resistance box was connected with the galvanometer through one side of the key, and the battery with the resistance box through the other side. The galvanometer was then adjusted to the point of maximum sensitiveness.

After removing all of the plugs of the coils, and charging with the battery for one minute, it was cut out and discharged through the galvanometer. At first the scale showed a deflection of 30 divisions, and at the end of thirty seconds it settled dead on 10 divisions, and continued so to the end of the observation, five minutes.

The plugs of all the other coils were conveniently replaced and the remaining ones charged for the same period as for the whole, each deflection being carefully noted, showing, in each case, that as the resistance decreased the deflection correspondingly increased. Finally, after all the plugs were replaced, I obtained a permanent deflection of 64 divisions. This circumstance rather perplexed me, and it is upon this point in particular that I wish to be enlightened.

Assuming that in replacing the plugs, the coils, being short-circuited, were then in shunt circuit, then, as the division of the current is inversely proportional to the resistance, the coils would receive so little of the current

in charging that it would not produce even the smallest deflection. The character of the deflection obtained is entirely the reverse of that obtained from the discharge of a condenser, which is instantaneous, the spot of light returning finally to zero or the place of starting.

Assuming the theory advanced in the article referred to above, that the coils were improperly paraffined and moisture condensing on and penetrating the silk insulation to the wire would set up an electrolytic action, I removed the lid from the box (which, by the way, has always been kept in a dry, heated room where the temperature varies but little) and carefully examined the paraffine. The coils were perfectly free from moisture of any kind and heavily paraffined with paraffine of an apparently high grade, well adapted for this kind of work, for it did not show even a crack. This disproved the moisture theory in this particular case. I have no theory of my own to advance, but would like to know the opinions of readers of this paper.

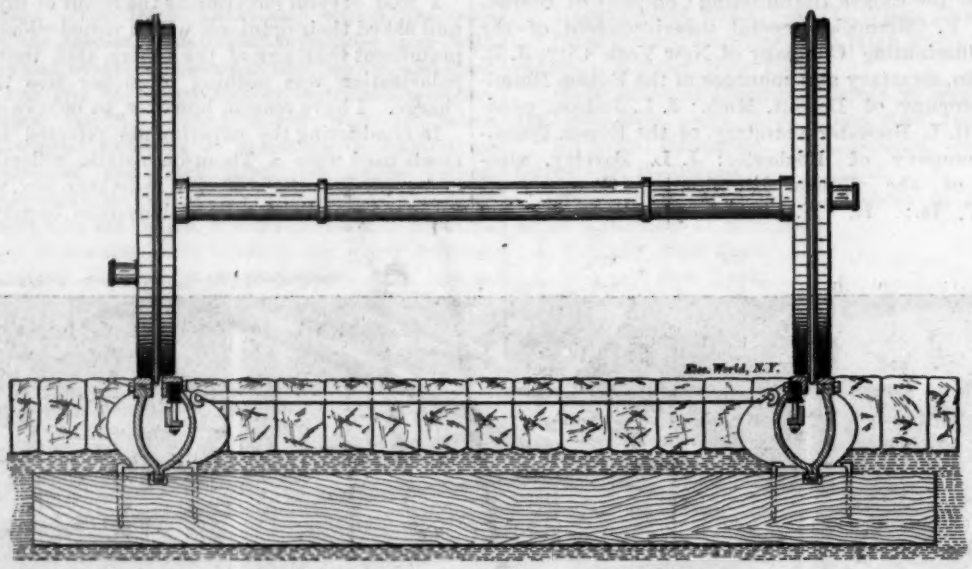


FIG. 1.—FIELD'S ELECTRIC STREET RAILWAY—DOUBLE CONDUITS AND TRACKS COMBINED.

The Field Electric Street Railway System.

In a recent issue we described in detail the electric motors designed by Mr. Stephen D. Field to operate upon the elevated railroads of this city, and which are now nearing completion. One of the distinctive features of this motor, it will be remembered, is the direct connection between the driving wheels and the armature shaft by means of a crank, so that motion is transmitted without any intermediate gear.

Since the completion of his design for the elevated railroad motor, Mr. Field has turned his attention to the adaptation of his system to ordinary street railways. The details of his new work present some highly interesting and novel points.

Mr. Field has started out with the idea of reducing the details to the utmost simplicity, so that high potential currents can be carried with safety, and that the position of the motor on the line shall make no difference in the potential at its terminals.

Taking up the mechanical design first, it will be seen from Fig. 1, which is taken from the actual working drawings, calculated on the basis of a ten-mile road with 100 cars on each track, that two slotted conduits are employed for each line of rails, the wheel flange running in the slot. The wheels shown are 30 inches in diameter and the conduits themselves are only 8 inches high. They are built up in lengths from two sections bolted together at the bottom, and let into the wooden cross-ties. Heavy ribs are cast on the sides of the section, which are calculated to withstand a vertical pressure at any point of 16,000 pounds to the square inch. In addition, tie-rods connecting the upper parts of the conduits lend additional stiffness to the structure and prevent any spreading or closing of the conduit slots.

It will be noted that the wheels have different treads on each side of the flange, the inner being of smaller diameter than the outer tread. On a straight track the outer, larger tread of each wheel bears on the track. But when rounding curves, the wheel bears on the smaller tread on the inner rail, so that it has a slower motion than the outer wheel, and thus the friction usually encountered is avoided.

The angle-rails which are bolted to the tops of the conduits are raised only ¼-inch above the level of the pavement, and, being rounded, present no obstruction to ordinary traffic.

These constitute the principal mechanical details of the road bed. Special provision has also been made for drainage of the conduits.

The electrical methods employed by Mr. Field in this system are again a decided departure from past practice, and the means employed in carrying out the system unique in conception.

In Fig. 1 it will be noticed that each rail conduit has supported within it a conductor carried on insulators.

The connection of these conductors with the source of power, the dynamos, is shown in Fig. 2. Here it will be seen a dynamo (taking one each for simplicity) is placed at each end of the line. At one end (the left in the illustration) the positive pole of the machine is connected to the conductor in one slot, while the negative pole of the machine is connected to ground; or, what is the same thing, to the iron of the conduit.

At the other end of the line, these connections are just reversed, the negative pole of the dynamo being connected to the conductor, and the positive to earth, or the conduit. Now supposing each dynamo to give 250 volts potential, it follows that the difference of potential *between the conductors*, and hence at the terminals of the motor, will be 500 volts.

The circuit is made from the conductor in one conduit

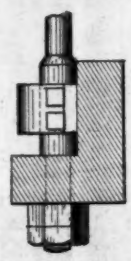


FIG. 4.

through the motor to the conductor in the opposite conduit, being completed through the two generators, conduits and axles of the cars. It will be seen that as the motor recedes from one generator it approaches the other, so that wherever the motor may be, it will be actuated by the same E. M. F., regardless of the resistance of the conductors.

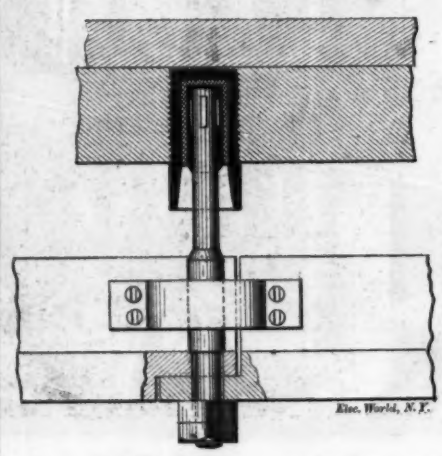


FIG. 3.

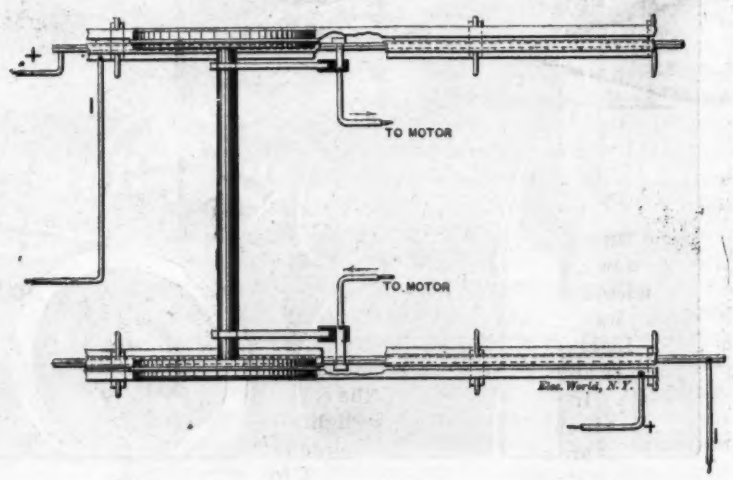


FIG. 2. FIELD'S ELECTRIC STREET RAILWAY SYSTEM.

The switching at either end of the line is accomplished by detaching the motor from the inside conductor and completing its circuit with one generator only from the outside conductor to the conduit direct, thus getting the E. M. F. of only one generator. At the same time the

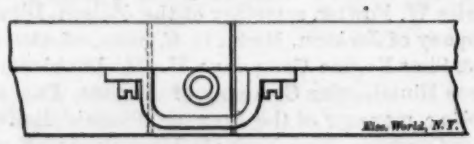


FIG. 5.

idle contact brush passes through the path of the inside conductor, which is removed for that purpose.

By this method of switching two objects are obtained. In the first place, the motor, by working on the lower E. M. F. (250 volts, instead of 500), passes the switch at a diminished speed, as it should.

But a still more important result is obtained by the use of the two conductors connected in the manner shown, and that is that all interruption to the electrical integrity of the conductors, and hence, also, the traffic of the line, is avoided. Thus, each car will be provided with a current manipulator, by which the motor can be put in connection with either one or both of the conductors, as it is evident that each one forms a complete circuit by itself, having an E. M. F. of 250 volts; but, when combined, they give a difference of potential of 500 volts. In this way all track switching devices are done away with.

The thorough insulation and stability of the conductors is provided for by the manner of their suspension and attachment. This is clearly shown in Figs. 3, 4 and 5, which represent longitudinal and transverse sections and a plan respectively of the arrangement. The conductor is secured to a steel rod embedded in a composite conductor. The inner and outer shells of the insulator consist of hard rubber, and between them there is a layer of vulcanized elastic rubber. The whole is vulcanized together so as to form one piece. By the addition of the softer rubber, the conductor is given a certain flexibility of motion, so that it can follow the pressure of the contact brush without undue strain on the insulator supports or pins.

At the joints of the section of copper conductors, a flexible bridge-joint is provided so as to allow for the expansion and contraction of the conductors.

Mr. Field intends also, in the line he proposes to equip, to lay pipes in the conduit through which hot brine will be circulated in winter so that all snow falling into the conduit will be melted. This device of course need only be put in operation during extremely cold weather. It will be noted that the conductors are placed at one side of the slot, so that any dirt or snow falling into the conduit passes clear of the former.

No extra appliances for cleaning the conduit are deemed necessary, as, being only 8 inches deep, it can be easily cleared of any refuse, with a shovel let into the slot, and by means of which the accumulation can be removed to the drains, which are provided at short intervals.

New York Subway Legislation.

The recent decision of Judge Van Hoesen, to the effect that the New York Subway Commission had exceeded its powers, has practically checked the work of putting the wires underground. In order to straighten out matters the following bill has been prepared for simultaneous production in both houses of the Legislature:

AN ACT to amend chapter 499 of the Laws of 1885, entitled "An act providing for placing electrical conductors underground in cities of this State, and for Commissioners of Electrical Subways:

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. Section 6 of Chapter 499, of the Laws of 1885, entitled "An act providing for placing electrical conductors underground in cities of this State and for Commissioners of Electrical Subways," is hereby amended to read as follows:

SECTION 6. The term of office of said Commissioners shall expire on the first day of November, 1889, or sooner, upon the performance of their function as herein prescribed. Each of the Commissioners so to be appointed, and each of his successors in office, is and shall be removable for cause, but only upon notice and after an opportunity to be heard by the Governor of this State, who has and shall have power to fill any and all vacancies, however caused, in the office of either of the Commissioners hereabove named. Wherever the words "general plan" occur in this act, they shall be construed to mean: A comprehensive system of underground conduits suitable for practical use in the operation of electrical conductors, and wherein electrical conductors may be operated without seriously impairing the efficiency of service, and it is intended by Section 4 of this act, in the event of no suitable plan being proposed or in use within 60 days from the 13th of June, 1885, to empower and direct such Board of Commissioners to cause to be devised and made ready for use such a general plan, and to clothe said board with full authority to cause such systems of subways to be constructed by contract with a private corporation or person, and to compel all companies and others operating electrical conductors in such cities to use such subways prepared as directed by said boards in accordance with the provisions of the laws of 1884, chapter 534, and of this act, upon fair and impartial terms, and for such use to pay such reasonable compensation, not in any case to exceed the cost of operating similar electrical conductors overhead, as such boards shall designate.

SEC. 2. All laws and parts of laws inconsistent herewith are hereby repealed.

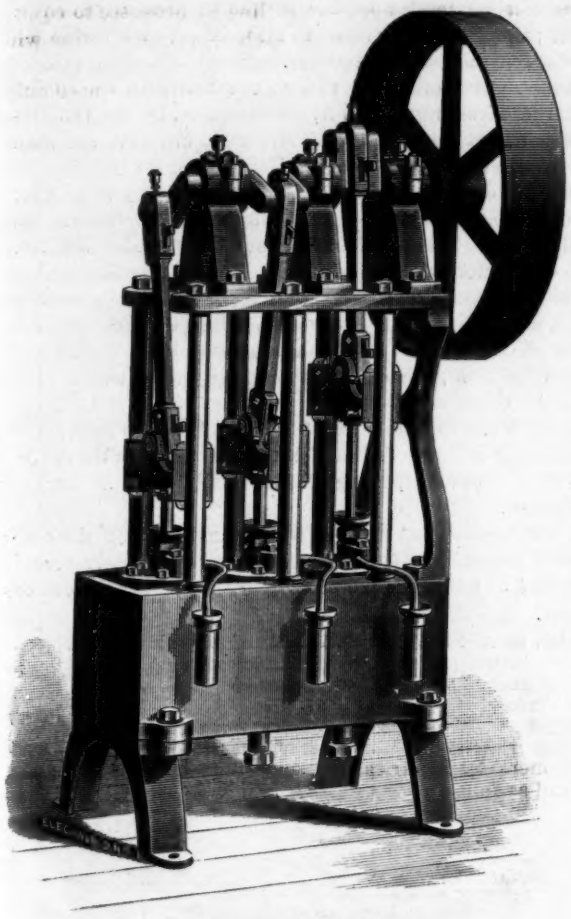
SEC. 3. This act shall take effect immediately.

If this bill is passed and becomes a law by the signature of Gov. Hill, its effect will be to confirm the acts of the

commission in letting the subway contract, under which the wires are now being buried in Sixth avenue from Fifty-ninth to Twenty-first street, and to retain Commissioners Moss, Gibbens, and Hess in office long enough to enable them to complete the general system of subways devised.

The Packard Vacuum Pump.

One of the most essential features in the manufacture of incandescent lamps is the obtaining of a good vacuum. The action of the Geissler or Sprengel mercury pumps, which are largely used for this purpose, is notoriously slow, but can be greatly accelerated by exhausting the greater portion of the air from the lamps before using the mercury pumps. For this purpose, as well as for raising the mercury in some forms of the Geissler pump, a mechanical vacuum pump which must fulfill certain requirements is needed. It must give the very highest vacuum



PACKARD VACUUM PUMP.

obtainable with a mechanical pump, and must be substantially built so as to be perfectly reliable and capable of continuous working. The use of water in the cylinders, which is the usual practice, is not permissible, as any aqueous vapor in the lamp or mercury pumps has an injurious effect.

Our illustration represents the Packard vacuum pump, manufactured by Mr. Norman Hubbard, of 93 Pearl street, Brooklyn, N. Y., which has been designed especially for use in the manufacture of incandescent lamps and to meet the requirements mentioned above. Several sizes, each with one, two or three cylinders, are made. The one shown is a triple pump with cylinders 4½ in. by 6 in., and shows the general design and arrangement.

The cylinders are placed in a cast-iron box, which serves as a bed plate and water-jacket, and on which the frame and working parts are mounted. The cylinders and fittings are made of composition or iron, as desired, iron being generally preferred, as it is not attacked by mercury. Each cylinder is entirely independent of the others, and hence they can be used separately or connected as required. All the parts are readily accessible, the wearing surfaces being of ample size and adjustable, to allow for wear. It is claimed that a vacuum of 29½ inches and over (the barometer being at 30 inches) is readily obtained with the pump. This result is made possible by an almost total elimination of clearance, and a simple arrangement of the valves by which they are opened and closed at the proper moment automatically, not requiring a pressure of air below them to do this work. Several of these pumps have been in use for over a year, and are giving excellent results.

Balloon Signaling.—In a paper just published in *Nature*, Mr. Eric S. Bruce, the English inventor of the balloon for signaling by the electric light, announces that he will soon put his invention to the most rigorous of tests—signaling across the English Channel at Dover. Mr. Bruce's balloon is made of a perfectly translucent material, filled with hydrogen or coal gas, in the interior of which are placed several incandescent electric lamps. The lamps are in metallic circuit with a source of electricity on the ground. In the circuit on the ground is an apparatus for making and breaking contact rapidly, and, by varying the duration of the flashes of light in the balloon, it is possible to signal by the Morse or any other code.

Automatic Cut-Out for Electric Gas-Lighting Circuits.

The great convenience afforded, and absence of danger from matches, by the use of electric gas-lighting appliances has made the latter a favorite method of igniting gas flames in dwellings. The gas-pipes as a rule form one side of the circuit and the wire leading from the battery frequently runs for a considerable distance along the chandeliers, and hence in close proximity to the return circuit. Notwithstanding the greatest care in construction, therefore, it becomes necessary to provide means for preventing the running down of the battery should a cross or short circuit be established on the line. An automatic cut-out is usually provided for that purpose. An ingenious form of this device has just been brought out by the Electric Gas-Lighting Company, of Boston. The instrument is shown in perspective in the illustration, Fig. 1, and, as will be seen, is arranged to protect six circuits.

The mechanism consists of six electro-magnets, each connected with a separate circuit, and all in connection with an electro-magnet placed in the clock-work of the apparatus.

The latter drives a long pinion *P*, which is clearly shown in the end view, Fig. 2. The electro-magnet in the clock-work is provided with an armature which normally strikes against the fan-wheel and stops the motion of the works. But when a current comes on the line, the armature is drawn away and the clock-work revolves, driving the pinion *P*.

Opposite to each of the circuit electro-magnets *M*, Fig. 2, there is placed a soft iron rack, which has a free longitudinal and vertical motion, being normally held forward under the tension of the spiral spring. At the forward end of the rack is a notch having an insulating material at its base. Upon the rack bears a spring finger, held on a post, and each gas-lighting circuit is completed through the springs and racks.

Let us now suppose that a flame is about to be lighted. The rack, which nominally is not in gear with the pinion, will be attracted by the electro-magnet *M* and held into gear with the pinion as shown in Fig. 2. At the same instant the magnet in the clock-work will have attracted its armature and released the work, which will start to revolve the pinion. We have described this action as one which might take place when a flame is lighted. But in reality the duration of the current is so short that the action is no sooner started than it is stopped by the breaking of the circuit, so that practically no motion takes place at the cut-out.

But let us suppose now that an actual short circuit has occurred on one of the circuits. The rack will be attracted by its particular electro-magnet, the clock-work will be started, and will continue to run so as to move the rack over to the left until the spring finger, Fig. 3, falls

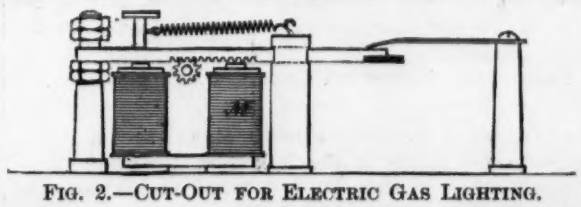


FIG. 2.—CUT-OUT FOR ELECTRIC GAS LIGHTING.

over the notch on to the insulating material and is held there against the action of the spiral spring. This of course breaks the circuit; the magnet is no longer energized, the spring draws the rack away from the pinion; and the clock-work is stopped by the armature of the electro-magnet within it which is also no longer energized.

The circuit affected then remains permanently cut-out, and when the fault has been discovered the spring finger can be raised by means of the crank shown in Fig. 1, which presses a rod against the spring fingers so as to raise them above the level of the notch.

The racks are all provided with discs, numbered to correspond with the binding posts of the different circuits, and when the racks are displaced in consequence of a short circuit the disc is displayed indicating the circuit in a prominent manner. Patents have been applied for.

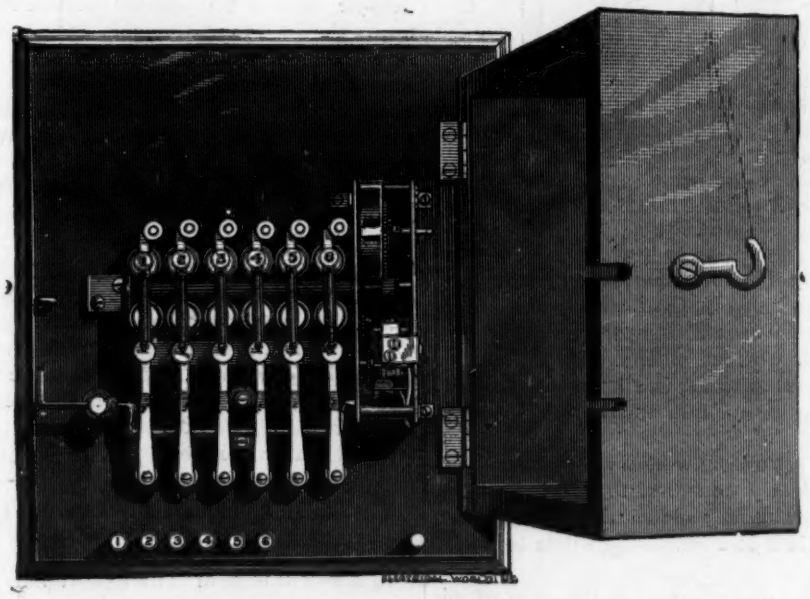


FIG. 1.—CUT-OUT FOR ELECTRIC GAS LIGHTING.

Electricity Generated by Steam Jets.

To the Editor of The Electrical World:

SIR: I have observed some facts in regard to which I would like to have some information, and which may be of interest to your readers.

A few days ago I extended a telephone line from one office to another, distant about a quarter of a mile. The end I started on was fastened to the building five yards clear of all other wires and perfectly open, and remained so until I had finished the distant office. While proceeding to put in the office wire at the latter station, I held in my right hand a double-braided, perfectly covered wire, and by chance my left hand came into contact with a gas pipe. I immediately got a severe shock, much more

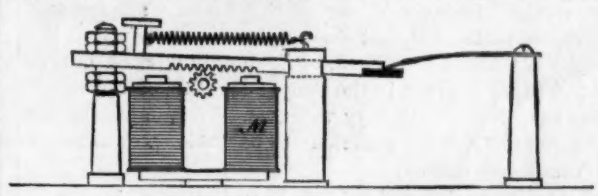


FIG. 3.—CUT-OUT FOR ELECTRIC GAS LIGHTING.

intense than that of a magneto, and I naturally commenced to experiment to seek for the cause of this unusual manifestation. Even when presenting the covering of the wire (not the naked) within a distance of 2½ inches from the pipe, quite large sparks were emitted. I also ignited the gas several times with it.

Not being able to conceive any cause for this action with the line open at the other end, I went over the line again to see if it had become crossed; but I found it entirely clear and open at both ends. On returning to complete my work I concluded to try the experiment again, but could at first get no effect; but suddenly the sparking reappeared.

However, I had discovered that the line runs directly over the safety valve of a boiler, about 12 feet above it, and I noticed that when the steam blew off the sparking manifested itself at the office; but when the valve was closed the action ceased entirley.

The question I would like to have answered is, How can this action take place with the other end of the line open? And I would be glad to hear the theories of some of your readers on the subject, and to know whether the phenomenon has ever been observed before. I may add that the same phenomenon was observed on an electric light wire in this place some three years ago. T. J. L.

JOHNSTOWN, Pa.

[The action noted by our correspondent is evidently identical with the one exhibited in Sir Wm. Armstrong's hydro-electric machine, in which steam jets issuing from a boiler are utilized to generate electricity of high tension. It is upon the very fact of the line being open that the experiment succeeds, for if an earth were provided, no accumulation of the charge could take place.—EDS. E. W.]

Birmingham, Ala.—Mr. W. A. Robman, agent for the Thomson-Houston Company, writes us from Birmingham, Ala.: "Fourteen months ago, we sold to the Birmingham Illuminating Company a sixty-light, steam, plant. Five months later, the company found their station too small. After purchasing thirty more lights, they began the erection of a large two-story building, setting in steam power for 500 arc lights. They are already running 150 therefrom. This station is nine blocks from the centre of the city. They now have also an incandescent station on Second avenue, between Eighteenth and Nineteenth streets, arranged for 5,000 lights. They are putting up 1,000 lights and will turn on the current about March 1." This is a good exhibition of faith, both in the growth of Birmingham, already a great manufacturing centre, and in the electric faith, and the faith is well-founded.

Walker's Sulphur Sal-Ammoniac Battery.

This battery, according to its inventor, Mr. Sydney Walker, is exactly similar to the Leclanché, except that in place of the oxide of manganese used as a depolarizer, pure sulphur of the size of a pea or small bean is used; and that the proportion of sulphur required is smaller, both by weight and by volume, than that of the oxide of manganese generally employed. Its E. M. F. is a trifle below that of the porous cell Leclanché, while its resistance is very much less. The internal resistance and life of the cell can be varied within large limits by altering the proportions of sulphur and carbon employed. More sulphur gives a longer life for given work and higher resistance; more carbon gives lower resistance and shorter life. The ordinary life is about the same as a Leclanché. The cell also possesses the valuable property of giving warning when it is worked out, or is subjected to an undue strain. In the working of the battery sulphureted hydrogen is formed, but does not come away unless the battery is worked very hard, or is nearly worked out, so that warning is given in the case of leakage, on house bell wires say, that will be very valuable. The amount of the gas given off is never sufficient to be noxious, even under the conditions named.

The action of the cell appears to be as follows:

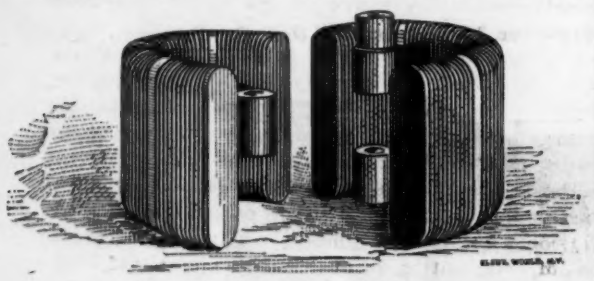
Starting with		2Zn,	$2NH_4Cl$,	S,	C.
First	Zn,	$ZnCl_2$,	$2NH_3$,	H_2S,	C.
Next	Zn,	ZnS,	2HCl	$2NH_3$,	C.
Next	Zn,	ZnS,	$2NH_4$,	Cl,	C.

so that the whole of the work, according to the inventor of the cell, is done at the expense of the sulphur.

Diehl's Gramme Armature.

One of the great objections to the employment of the Gramme type of armature in small motors heretofore consisted in the fact that it was impracticable to wind them on account of the small interior space within the ring.

In order to overcome this objection Mr. Ph. Diehl has



DIEHL'S GRAMME ARMATURE.

designed a form which permits of easy winding. He accomplishes this end by dividing the armature into two parts This is shown in the accompanying illustration, which exhibits the armature taken apart. As will be seen, it consists of two half rings, of which one has a single, and the other a double eye attached to a spoke in each half-ring, In other words, the arrangement is exactly like that of a door hinge.

The half-rings are separately wound with wire, which can be very conveniently done, and then, being pressed together, the eyes come in line; and the shaft being passed through, like the pin in a door hinge, the whole is firmly bound together.

Mr. Diehl has recently also remodeled the field of his small motors so that the whole presents the appearance of the little motor shown on page 79 of our last issue.

Werner Siemens.

There are few names so prominent in the history of electricity as that of Ernst Werner Siemens, whose portrait is given in the accompanying engraving. Werner, the eldest of the Siemens Brothers, well known to science, was born Dec. 13, 1816, so that he has now just entered on his seventieth year.

After the usual German high school course, Siemens, at the age of eighteen, entered the Prussian artillery service as a volunteer, and during his term he studied the sciences and technology at the Artillery and Engineering School at Berlin.

Siemens' attention was first drawn more particularly to electricity by the electrical method of measuring the velocity of projectiles then just brought out, and, together with the mechanician, J. G. Halske, he devised a needle telegraph in the year 1847, which soon came into general use on German railways. The founding of the great firm of Siemens & Halske also dates from that year. In 1849 Siemens resigned from the army, and for several years following devoted his attention to telegraph construction, and especially to underground work.

In the year 1857 he invented the well-known Siemens polarized relay and the Siemens double T armature.

During all this time he carried on a large number of investigations in electricity, and in 1866 he discovered the leading principle of the dynamo-electric machine by which permanent magnets were no longer made necessary. It would take us too long to enumerate all the works of this great scientist and inventor; suffice it to say that there is hardly a branch of science in which he has not made original investigations of marked importance.

Werner Siemens has two sons by his first wife, Arnold and William, who are now partners in the firm of Siemens & Halske. By his second wife he has a son and a daughter.

We join in the general wish of the members of the Berlin Elektrotechnische Verein for the long life and continued prosperity of the founder of their society, and we are sorry that he cannot pay this country a visit to learn how highly he is appreciated by American electricians.

Hall's Phenomenon in Gases.

Professor Boltzmann has recently detected the existence of Hall's phenomenon in gases, the rotation of the equi-po-

ERNST WERNER SIEMENS.

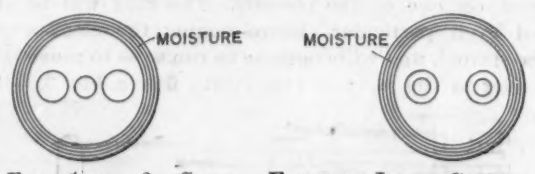
tential lines for carbon di-oxide, hydrogen and air being in the same direction as for gold. The experiment, according to the London *Electrician*, was made by means of a Geissler tube of rhomboidal section, in which the gases were exhausted to the pressure of 2·5 mm. The current from the induction coil entered and left the tube at the acute angles of the rhomboid, and two separate platinum electrodes inserted at the obtuse angles were connected with a very sensitive galvanometer. When the tube was placed in a uniform magnetic field such that the lines of force were perpendicular at the same time to the direction of the current in the tube and to the line connecting the secondary electrodes, a current was set up in the circuit of the latter, which, as already stated, was in the same direction as in Hall's experiment with gold leaf. Professor Boltzmann also took two similar Geissler tubes connected in parallel, so that the current divided itself nearly equally between them. If a magnetic field directed perpendicularly to the current were then set up in one tube, the current in this tube was observed to diminish to one-tenth of that in the other.

Safety Circuit for Electric Lighting.

BY T. J. PERRIN.

In a recent issue of THE ELECTRICAL WORLD* there appeared a short notice of a device, credited to Mr. E. T. Greenfield, for counteracting the effects of short circuits, in lamp circuits or branches, caused by moisture saturating the covering of the wires. At the first glance, such a method would appear an efficient one, but on closer examination it hardly appears to be at all practical, and, in fact, I am convinced that such an arrangement, as shown, would in no way fulfill the function claimed for it.

As stated before, the prime object of this device is to guard against the permanent short-circuiting of the two prime conductors, the third or inner wire acting as a re-



FIGS. 1 AND 2.—SAFETY ELECTRIC LIGHT CIRCUIT.

turn to either of the lamp wires, in case of such a circuit being set up by means of the leak from either lamp wire, to the third or auxiliary wire. Such an arrangement would fail of its purpose simply from the fact that any moisture which would affect either of the wires must necessarily come from the outside of the cable and work to the inside; and it will be plainly seen that a circuit would be formed between the two outer conductors, through the dampness affecting them at their outer circumferences, long before it could affect the third wire.

In the accompanying diagram I have shown, at Fig. 1, how this would occur.

The fault might be remedied to some extent by placing the third wire outside of either of the lamp wires; but again, at second thought, even that would be no improvement, as moisture would reach the lamp wires just as soon, and the result would be merely to make in one case a short circuit between the third wire and wire No. 4 of the Greenfield diagram.

In view of all this, and the possibility I have just shown that even the appliance itself is liable to be short-circuited, there does not seem to me to be any way in which the device could be of use, and even if there could be any arrangement of the wires devised to make it serviceable, it would only be in the form of a cable, and separate wires are used as often as the double conductor cable.

In the accompanying diagram, Fig. 3, I have, however, shown a method devised by myself some time ago which is, I think, a simple and practical one. Fig. 2 represents an end view of the cable, if a cable is preferable.

Each conductor is made up as follows. The conductor *w*; then the insulation *g;* around the insulation is wrapped a ribbon of foil *f*, of suitable size, and then the outer covering *a*. Although I have only shown two sections of this cable, still the whole of the cable to be used throughout a building would be similarly constructed. The line wires can be used together in the form of cable or run singly; their use is the same in either case, and would be as effective one way as another.

The conductors *w* are run to the lamps in the usual way, the wires running to it, accompanied by the foil ribbons *n n*. By following the different circuits, the plan will be readily understood.

The first circuit will be from the generator by main No. 1 to house branch No. 1, through safety fuse *F*, to conductor *w*, to lamp. Next by main No. 2 to branch No. 2, to conductor *w*, to lamp.

The second circuit will be from main No. 1 to branch No. 1, through safety fuse by dotted line to one terminal of the electro-magnet *M*, through magnet by dotted line to ribbon foil at *h*; thence by foil through the entire length of cable, being normally open at its extreme end. Next by main No. 2 to branch No. 2, to foil of second conductor connecting at dotted line *b*; thence through the entire length of conductor, being also normally open at its extreme end.

It will be observed that the foil around each of the conductors is insulated from the conductors themselves, and each line of foil is connected to one side of the generator circuit.

Now, in case that the foil circuit is crossed or closed

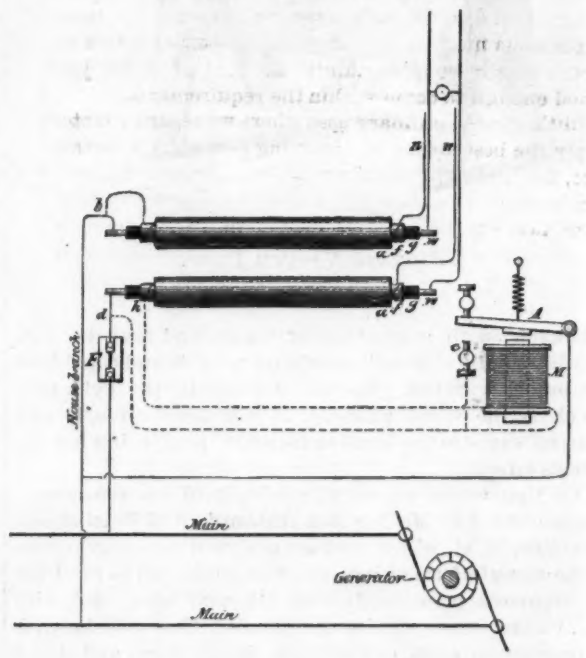


FIG. 3.—SAFETY ELECTRIC LIGHT CIRCUIT.

anywhere along the circuit, either by moisture or through the abrasion of the covering by pipes, speaking tubes or the like, the electro-magnet will immediately respond; the armature *A* will be drawn down to the stop *c*, which will short-circuit the house-branch, in which is included the safety fuse; and if the fuse is of the proper kind it will perform its function and leave the branch circuit open.

This will be readily understood by following the circuit, as before traced. It will be seen that it is a matter of judgment as to where the electro-magnet should be situated, and as to how many of them would be necessary; but one could be introduced into every branch circuit, and operate that circuit only, and it will be understood that a safety fuse should also be introduced into that part of the generator circuit to be acted upon or short-circuited by means of the electro-magnet.

In conclusion, it will be readily seen that any trouble arising from without or within the cable must affect the foil circuit before it can affect the lamp circuit, and the magnets would respond to a current and perform their work long before that current could get strong enough to do any harm.

It is a well known fact that a large percentage of the troubles of electric light wires comes from leakage caused from moisture, or by the wires crossing metallic substances, such as described above, and such a method as shown here must prevent these troubles more or less. At any rate, I consider it worth trying.

* See ELECTRICAL WORLD, Jan. 22, 1887.

The Practical Requirements of Small Motors.*

BY S. S. WHEELER.

It is a remarkable fact that not only have none of the small electric motors thus far put upon the market been constructed on the same principles as those of an efficient dynamo machine, but no attempts seem to have ever been made to copy large machines in the very features which are known to make them efficient and practically serviceable.

Any electrician, in looking at the motors heretofore offered to the public, can see at a glance why they cannot have a good efficiency, why their resistances are necessarily high, why they have to be run at too high a speed, or why their commutators will spark badly and quickly wear out, and why it is entirely out of the question to use them for giving power in thousands of cases. And yet, notwithstanding that these objections are almost entirely removed in large motors built exactly like large dynamos, no small motors have ever been manufactured before which are any approximation to the larger machines in these important respects.

Probably the most important reason why so little attention or electrical ingenuity has been given to the subject of small motors is that the energies and inventive faculties of electricians have for the past three or four years been devoted to the problems of the transmission of large amounts of power, and especially the propulsion of street cars, etc., which present great difficulties, but difficulties that electric motors are especially suited to overcome. The natural result of this prospective demand for such sizes and kinds of electric motors as this work will require, has been the diversion of the best electrical talent in this direction, and the consequence has been the production of such machines, almost perfectly adapted to the requirements.

Meanwhile the subject of small motors has lain comparatively unnoticed. Each isolated want is of less importance to the user and of less value to the dealer than in the case of a large motor; in other words, as the small motor to be successful must be cheap, and the power to be supplied is small, there is little money in each individual case, and it is only when the number of individual users gets to be large that the matter of small motors becomes a promising field. It does not follow, however, from the lack of attention bestowed upon the subject, that there is no field for such work; on the contrary, there is an enormous number of individual instances where an an electric motor would certainly be used if it be just just good enough to come within the requirements.

In addition to the ordinary uses where we regard a motor as simply the best means of obtaining power for a certain purpose, for example the running of a large number of small machines in a factory, where the motors and feeding wire take the place of shafting and belts, there are many places where the work would not be practicable without one, and where a motor therefore would be said to create the use. Such are all uses of very small amounts of power where an engine cannot be run, and which are beyond the capacity of a man at a treadle. There is a large class of uses for power where a steam engine is not admissible, and where a good motor on a circuit is the only alternative, and in the absence of a motor good enough to be safe on an electric light circuit, or efficient enough to be run economically, all these industries have to be conducted in other ways, to avoid the question of small power distribution.

The response to the demand for electricity for lighting, etc., has been the production of dynamos of ninety-five per cent. efficiency, a far better result than is obtained in steam engines, and conversely these dynamos can be used as motors with the same efficiency. But the result of the needs of electric lighting, in response to which demand these dynamos have been created, is that they are machines of large power, and so in these we have motors of large power without further change, save as to means of regulation.

Now why is it that we have not already had for some years motors of very small power, and reasonably near the same perfection of efficiency?

It is because a small motor while requiring the electrical construction and efficiency-giving features of a large dynamo to be equally efficient, cannot, for several reasons, be made an exact miniature of the large dynamo in mechanical construction.

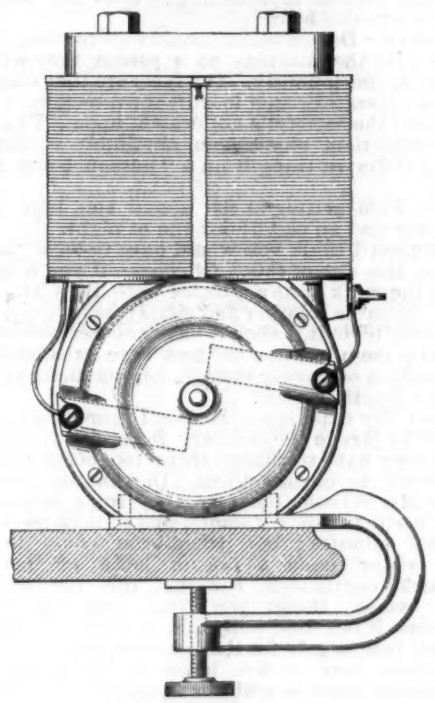
If you want a 1,000 horse-power engine, you will get a Corliss engine, with elaborate valves, adjustments, etc. But if you want one of one horse-power, you will not get a miniature of the Corliss engine, requiring an engineer to take care of it. You will get a Baxter or an oscillating cylinder engine, with no external valve gear or adjustments, which will almost take care of itself. You must to make a small motor successful for such practical purposes as it is to be used for, reduce the complication of its parts and its liability to get out of order.

Of course this is realized by every one who has given the subject any consideration, but, nevertheless, the practical result has been that the only small motors thus far produced have been made apparently without any analysis of the difficulties to be met and any consideration of the means for overcoming them. Many of these motors have been so entirely unsatisfactory that they have been looked upon as little better than toys, and have reacted discouragingly upon the public.

Some of these motors, if placed on an incandescent circuit, for which they are intended, will burn themselves up. Others are of such very low efficiency compared with dynamos, that they require treble and quadruple the amount of current to give the necessary power. This is the principal reason why small motors, run from batteries, have not been more successful heretofore. The batteries have not been particularly bad, but the motors, instead of making good use of the current furnished, which is costly at best, have simply slaughtered the battery when pressed to do the work, by drawing four times the amount of current which would do the work, if efficiently used. I refer of course to the failure of the motor to give a counter E. M. F. when running, to which is due this inefficiency. The E. M. F. generated by a machine when driven as a dynamo, is the real test of its efficiency.

In order to get counter E. M. F. or magnetic effect, which is the same thing, and which is shown by running the motor as a dynamo and observing how much current it will *generate*, it is necessary to have a strong field, a large number of convolutions on armature, and high circumferential speed, all of which are interchangeable as factors; while at the same time the resistance of the wire and the speed of the armature must be kept down. The first is necessary so as to permit strong current effects to be produced and large power to be exerted when the motor is running slowly, as well as to reduce the loss from the internal resistance of the machine; and the second, to avoid high working speed, which is always undesirable, for mechanical reasons. It will be observed that all of these requirements tend to the enlargement of the machine, especially of the armature.

These considerations lead to the conclusion that it is better to make the armature a little larger proportionally than it is made in large machines, in order that our very small



THE C. & C. MOTOR.

motor may still have the proper amount of wire, etc., in the armature, and be a true dynamo, capable of giving a proper E. M. F., instead of being a mere electro-magnetic engine. By so doing we also make the armature much easier to manufacture.

There is now before the public a small motor, of which we have some specimens here to-night, in which the armature is enlarged radially somewhat, out of the usual proportion of armature to field, whereby the comparative strength of the field is perhaps reduced a little; but the armature capacity is increased in a much greater ratio, and consequently the E. M. F., or magnetic pull of the machine is large, and the internal resistance as well as the shaft speed, are small.

In addition to this departure from the usual proportion in order to meet the difficulties of small motors, there are a great many special features to increase the convenience as well as the efficiency of the machine.

As I believe this motor to be the first one on the market giving an efficiency corresponding to large dynamos, and at a price proportionate within twenty-five per cent. of the established prices for large machines, I think a description of it will be of interest. (I may say here that later on some tests will be shown, and an opportunity will be given of examining the motors and apparatus.)

The field magnets (see the accompanying illustration) are of the simple horseshoe shape, and the armature is a Gramme armature of comparatively large diameter and short length. The Gramme ring gives room for a large number of windings, with small mass of iron to be magnetized, and the large diameter, compared with the length, gives greater circumferential speed, with the same windings and mass. The cores of the field magnets are of best wrought-iron, 1⅛ inches in diameter and three inches long. The yoke and pole pieces are of equal section with the core, as is also the armature core, thus forming a magnetic circuit all around the horseshoe and across the armature, of uniform conductivity. The yoke and ends of the cores are cut clean by machinery, and firmly bolted together, and the iron fibre of the pole piece continues up into the core, both being in one piece and of equal section. The non-magnetic base-plate extends around underneath, and forms a clamp for fastening the whole motor firmly to the edge of a table, a point of great convenience.

The armature is built up of about forty semi-circles of thin sheet-iron, riveted together with two long rivets, into a solid ring hinged on one rivet, so as to open on the opposite side to receive the winding. These thin laminæ of soft iron are separated by tissue paper, to prevent the generation of Foucault currents, precisely as it is done in the largest and most efficient dynamos. The complete armature winding, previously formed by automatic machinery, is slipped on to this split-ring, which is then closed, the open ends of the half circles fitting into each other when brought together, forming a mortised joint, which is then secured by driving a final pin or rivet through them. When this hinged ring is closed, the core forms a hollow cylinder 3 inches in diameter, $\frac{5}{16}$ inch thick, and 2 inches long.

The armature winding consists of a flat wire or ribbon, wound on edge into a single helix, the full length of which equals the circumference of the armature. The commutator, which is of the disc type, consists of seventeen copper sectors riveted to a fibre washer. The latter is attached to a cylindrical wooden block which is turned true with the shaft of the motor, and to a tight fit for the inside of the ring, after the winding has been slipped on it. This block and shaft are then forced into the centre of the ring, until the outer extremities of the commutator sectors are brought within about ¼ inch of the winding on the ring. The claw-shaped outer tails of the sectors are then bent together, pinching tightly certain loops of the armature helix, which project out farther than the main body, for this purpose.

These high convolutions or loops are then soldered to the commutator strips, making a solid and extremely simple and reliable connection.

The armature shaft is mounted in bearings, which are screwed to both sides of the pole pieces. The brushes are each held by a single screw, which also makes the connection with the leading wire, and, with the co-operation of the bearing plates, holds the brush at the proper inclination. The armature of this motor has room enough for a winding, such as described, composed of two hundred and four convolutions, and of sufficient conductivity to carry twenty ampères, half of the current passing around each side of the armature. Therefore we may say that the magnetizing capacity of the armature winding is two thousand ampère turns. Of course, the size of the wire in the armature may be changed to suit the circuit, so as to give a higher E. M. F. and less ampères, and still utilize the same amount of volt-ampères within this limit. Thus we may substitute for the two hundred and four turns on the armature, four hundred and eight turns of wire of half the size, and still get the two thousand ampère turns, when used on a ten-ampère circuit. The field is wound so as to carry the same current. The company is at present winding its motors with three styles of windings; the style designated A is adapted to be used on 20 ampère circuits, such as the United States company's arc light circuits; another style, designated type E, is wound for 10-ampère circuits, such as the Brush arc circuits; and the third style, designated L, is wound for 100-volt circuits or thereabouts, such as the Edison incandescent circuits.

In regard to the power and efficiency of these motors, I have found that when running at 1,500 revolutions per minute, a moderate speed for motors of this size, and, therefore, taken as the basis of tests, the 20-ampère motor, or type A, with 20 ampères passing through it, shows a difference of potential across its binding posts of 7 volts, 5 volts due to counter E. M. F., and 2 volts due to resistance. This means 150 volt-ampères consumed in the motor, or a little more than one-sixth of an electrical horse-power. Under these conditions a Prony brake shows a pull of five ounces on a one-foot lever; that is two foot-pounds per revolution, or about one-tenth actual horse-power at 1,500 revolutions per minute. The windings for other circuits give results to correspond. Therefore, when the motor is running with all the current it can carry, it uses about one-seventh horse-power of electrical energy and gives about one-tenth horse-power of useful power, or 50 per cent. of the energy used, allowing for slight additional losses, which is about double the efficiency of any small motor which I have examined. And this performance is with a current heavier than can be carried by other motors. When running with about three-fourths of this amount of current, or about 15 ampères, the efficiency is considerably greater, reaching about 60 per cent. This is the best working load for the motor, because the loss by the resistance of the machine is less. But when we get down to about seven or eight ampères we find that the efficiency falls again, owing to the approach to the limit of weakness in the field. And when we reach four ampères, we find there is just field magnetism enough to turn the machine.

The loss of this initial current of four ampères in charging the field, is unavoidable, on account of the necessity

*Read before the American Institute of Electrical Engineers, Feb. 8, 1887.

of having enough mass of iron in the field to use the full two thousand ampère turns that the motor has, when fully charged, without bringing the iron too near the point of saturation, or, in other words, to make the motor large enough to use ¼ h. p. of current, without passing the point of saturation. Hence we see that if a motor is intended for use with a small current, it is better to make the field magnets of smaller diameter. This is another illustration of the difficulties to be met in making motors which will be good under varying loads.

In regard to its use as a generator, the motor with 20-ampère winding will give about 5 volts when running at about 1,500 revolutions per minute, and as its current capacity is 20 ampères, this means, allowing ¼ volt lost by resistance, 90 watts, or about ⅛ h. p. of electrical energy in the external circuit. That is, enough to light a 16 candle-power lamp. By changing the size of wire and putting on sufficient convolutions to get a high E. M. F., we get a generated current of 1 ampère and 90 volts, sufficient for a 16-candle light, with a consumption of ¼ actual h. p.

As the motor was originally designed for domestic use in running sewing machines with a battery, the current from which is necessarily very expensive, great stress was laid upon designing it so as to make the very best possible use of the current, for the sake of economical running, and also to make the motor as small and light as possible with the capacity required.

This latter consideration led to the immediate determination to use the very best wrought iron, and it is only by making these necessary elements of good construction the first consideration in their manufacture, that a motor of this surprising efficiency has been produced.

In proof of the correct design and success of these motors, it may be interesting to hear that the semi-automatic machinery which was originally made for their manufacture has been kept in operation continuously for the last three months without interruption, and that already over six hundred of the motors are in use.

DISCUSSION.

Mr. S. F. Shelbourne in the chair.

Mr. P. DIEHL: I have made experiments on electric motors, and have succeeded in making various types. One of these I have placed on the market; but since then I have made quite a number of improvements. I have finally come to the conclusion that the armature to be put in this motor should have more sections. The one which I have been making has only four sections, and the sparking is considerable at the commutator, but I have lately produced various motors, especially one to run sewing machines, by placing the motor directly within the sewing machine—that is, putting the motor entirely within the sewing machine wheel, so that nothing can be seen of it. It is on the end of the shaft, directly connected without any belting.† There is a great gain in that, as you can do away with the friction of belting, which is considerable on a small motor. In those motors which I produced before, the armatures were too small. I have found that the armatures have to be enlarged. I have built armatures on the Gramme type, and I found for a small motor about three inches to be the best size. I have made armatures in sections, of two halves, which are of easy winding; but otherwise the field is about the same as the one I previously made. The motor I intend for a sewing-machine exclusively is entirely in the wheel of the machine. It is a Gramme ring, made in two sections and held inside in the wheel. It is held in position by screws, so that it can be centralized. I have a field magnet in the inside of the ring, which gives me very good satisfaction. The wheel and motor together weigh about five pounds. The wheel is only the housing for the motor. For fans and for such purposes I have built it in a different shape, but I use also the Gramme ring. I have come to the conclusion that it is a better shape than the T armature.

Mr. G. W. MANSFIELD: I certainly would speak most heartily in commendation of the ingenious methods which the C. and C. Company have adopted and devised for overcoming some of the most difficult mechanical questions which existed in the early constructions of the small motor. I do not know but that the main reason why the Gramme ring was not used for small motors at an earlier date was the fact that the armatures could not be wound cheap enough to answer the purpose. They had to thread the wire in through this little ring and out again by hand, and the method adopted by the C. and C. company has certainly overcome that difficulty in a very nice way. I think that in overcoming that difficulty they have started in on a sound theory, that small motors can be built just as efficiently as large motors, and there is no reason, hardly, why they should not. Of course, if the analogy can be carried out, we all know that small steam engines cannot be built to operate as efficiently as large steam engines.

Mr. WING: I would prefer to listen a little longer and to ask a few questions before undertaking to address the meeting at length. One of them is the question of batteries, primary or secondary, or any other kind. Are any here prepared to answer as to any of the existing batteries being practicable for long periods of time, so that the purchaser of a small motor can afford to run it? I have investigated quite a number, and, so far, none of them have proved satisfactory. I would limit the question to three horse-power, one horse-power will do. If I sell a sewing machine, or a fan, or a lathe, or anything else, I want to know commercially how long I can guarantee that battery to run and how much it will cost to run it per day, per week or per month.

Mr. WHEELER: I might perhaps give you some figures about the batteries we are making; but I think on points of exact science, about the cost of running them, etc., I could refer you to Mr. Crocker, who is one of the mechanical experts of the company, and who has more figures in his head than I have. I might say, however, that our battery is an electro-poion battery, having no porous cup. Instead of using carbon plates we use pencils. We use the regular electro-poion fluid, except that it is a solid. Here (exhibiting) is some of the material, and if we add pure water to that and analyze the solution, we will get almost exactly what electrical dealers call electro-poion fluid. We do not have to use jars any larger than you would in a Bunsen battery. The amount of chemical energy in this solution is just the same as it is in the same volume of the ordinary electro-poion fluid.

Mr. WING: I have found this difficulty in all those with which I have experimented, that when you come to take them commercially, there is the inconvenience of emptying the jars and replacing them.

Mr. WHEELER: It is giving that point due consideration which has led this company to produce a battery jar, which has a very suspicious appearance (exhibiting a porcelain jar provided with a handle. Laughter). As that has got about a tenth of a horse power in it, I do not want to upset it.

Mr. MAILLOUX: How many sewing machine hours has it got?

Mr. WHEELER: It has got about six sewing machine hours. The electromotive force is $8\frac{5}{10}$ volts; the internal resistance is about $\frac{5}{100}$ of an ohm. When you begin to use it, it rises up to about $\frac{15}{100}$ of an ohm, when the solution is mixed up with the acids of the reaction. The resistance is, therefore, higher, so that the fair average is about $\frac{1}{10}$ ohm internal resistance, and the capacity of the battery is 12 ampères. It will keep on furnishing 12 ampères without declining until the chemicals are all used up. If you short-circuit the battery it will give more ampères than any battery that I know of. I have got one that will measure up to 45 ampères, and it will give even more ampères than that. It will give about 50 ampères on a short circuit. Of course it will not keep that up more than three or four minutes, because the solution will not circulate fast enough to bring fresh material up to the zinc in time. It will stand 20 ampères for five or ten minutes, but it will easily stand 10 ampères continually. It does not furnish 12 ampères to run a sewing machine for six hours because a motor, when running a sewing machine, will use only about 8½ ampères. Of course, the resistance of the motor will allow about twice that amount to flow. It takes two of these jars to run a motor at a lively rate; one will run it.

Mr. WING: Suppose you want to run five or six hours during the day and eight or ten hours at night, how many cells would it be neccessary to have and how long would those cells last without replenishing? I do not mean to get right down to the hour.

Mr. WHEELER: Do you mean continuous running? You know if you give the machine to a person they will say that they use it continuously. The facts are that they sew for a minute; then they stop to shift the direction of their seam, etc., and the battery is not drawn upon. I have to make that distinction, because an absolutely continuous run is a very different thing from a "human being run," so to speak.

Mr. WING: I am getting at the actual run, four hours during the day and eight-hour run at night.

Mr. WHEELER: I think you would have to have jars of about twice the size of this. Of course, if you were not going to do the work at any greater rate than this, you could use the same solution and simply have larger jars. If I were going to do it, I should have another pair of jars ready and slip them in when the first were exhausted. It is only a question of having enough solution there to keep it up for that length of time.

Mr. WING: My experience is that I cannot sell a machine to run by jars in the ordinary form, for the simple reason that they have to change them too often and it is too much work to change them. In running a sewing machine, as Mr. Wheeler observes, they run a minute and then they do not run a minute, and sometimes do not run for ten minutes; but when you come to put this same motor upon a fan or lathe or machine that requires continuous running, the fan is probably the worst thing you can put on to a motor, because it is a dead pull from the time you start it. Now, we sell fans largely for that purpose, and they want to be run about four or five hours for office business. Many thousands could be sold for ventilation of private residences, sleeping-rooms and the like if we could get a battery, or if we could get the power at a moderate price to run those motors during the sleeping hours, say eight or ten hours, but it must be a steady run.

Mr. PENDLETON: I think if the circuit were established from central stations, there would be no difficulty in running either a fan or sewing-machine satisfactorily. At the present time you are obliged to do what you can with the best batteries in existence at the present day.

Mr. CURTIS: I thing the kind of fans Mr. Wing refers to chiefly are fans that require more than half a horse-power to drive them.

Mr. WING: No, sir; a thousand could be sold for that purpose at about one-eighth to one-fourth horse-power, for sleeping-rooms. This motor has got the power for that purpose, as I can see from the speed at which it runs the fan here. One-eighth or one-fourth of a horse-power will do very well for sleeping-room purposes, and thousands will be sold for that alone.

Mr. CURTIS: The power of one of these batteries is about $\frac{1}{16}$ to $\frac{1}{8}$ of a horse-power. Now if you want $\frac{1}{10}$ of a horse-power you would require four to six of these batteries. A tenth of a horse-power on a small motor is a good deal more than you would expect. When we were running it here, we were running from the Edison circuit and we were taking about as much current as one of these lamps takes. We were taking a little more, a tenth of a horse-power.

Mr. WING: A tenth of a horse-power is ample for the purpose I referred to.

Mr. CURTIS: The question is whether somewhat less than a tenth would be enough.

Mr. WING: It would be for smaller rooms.

Mr. CURTIS: When we took up the problem we found that there was not any battery in the market which, unless we used a good many cells would give anything like the necessary current. Now the only way to get the power out of that is by fulfilling two conditions. In the first place you have got to have large plates so that you do not draw a heavy current over a small surface. In addition to that, you have a very low resistance. As soon as the resistance of your batteries comes up, you have got to add cells. The resistance of the two cells is only $\frac{1}{15}$ of an ohm, which is ridiculously low for a battery of that size. There is not any battery made to-day which is as low as $\frac{1}{15}$ of an ohm for one cell except a very large plunge battery. Now the only battery which would take the place of this that could be used to give the same volts and ampères before we got this up was something like a Bunsen battery or an ordinary plunge battery. The difficulty with the plunge battery was that it would not maintain a current; there was no circulation of the liquid; and then if we put the plates nearer together the circulation would form the sulphate of zinc on one plate and form the water on the other plate and we could not maintain the action, and you had to stop and give it a rest and then start off again.

Mr. WING: That has been my experience in all that I have tested.

Mr. CURTIS: That is eminently the case in any form of battery where provision is not expressly made for circulation. In this battery we can get from about a square inch of surface about an ampère. You take a battery with a porous cell in it, or an ordinary plunge battery, and it will have perhaps 12 square inches to the half ampère. This battery will give from five to ten times as strong a current for a given area of zinc as any battery I know of. We seem to have got as near the limit of lowness of resistance as possible, because unless you can lower the specific resistance of the solution, you cannot bring your plates any nearer; there is nothing intervening which you can take out and you have got the resistance as low as you can get it.

The only way in which you can get power enough out of this kind of battery to give you one-tenth of a horse-power is by adding cells or making larger cells. Now, you can do that easily enough. But nevertheless it involves having the cells four times as large or having four times as many of them. Then the domestic conditions come in; perhaps you can use it; perhaps you cannot. There is not any battery at all that it is worth while to talk about for a half horse-power, entirely irrespective of the cost of solution. The solution is quite a costly thing, anyway. The cell we employ will give a fortieth of a horse-power continuously for, say, six hours. That costs one charge of solution, and one charge of solution costs about thirty cents. So it costs thirty cents for six hours. There is no difficulty in obtaining all the power you want if the electric light circuits are there. We anticipate that all cities are going to have arc or incandescent circuits for domestic use, and we propose to put our motors on those circuits. You can put one of these motors in the place of one of these lamps here, as we do now, and it will give you a tenth of a horse-power.

Mr. WING: Do you intend to build your motors for arc circuits?

Mr. CURTIS: Yes; we have some already built. They are boxed up to protect them, that is, to protect the people outside of them from touching them and getting a shock.

Mr. WING: Do you have to have any resistance coils?

Mr. CURTIS: We have a shunt which controls them. They have a multiple arc with a variable resistance.

Mr. WING: I have understood that you have already put some on the Brush circuit. Have you arranged with them as to charges?

Mr. CURTIS: In some of the cities we have. We have not arranged in New York yet. The Brush people are trying it now. Mr. McGrath, who is superintendent of the district in New York is trying it for his own station. I believe he says that they are just what they want for their circuits.

Mr. WHEELER: Mr. McGrath reports forty-five per cent. efficiency on his circuit with this motor.

Mr. WING: He told me they were prepared any time they got a motor that was satisfactory to them to put it in. I understand that in Baltimore the Brush people have agreed to furnish the Baxter motor with a horse-power at five dollars a month. They are doing it right along all the time, for one horse-power or ten little ones at the same rate. They are putting them in a great many places where they are using sewing machines.

Mr. MARTIN: In Philadelphia the Brush Company are running about 200 small motors on their arc circuits.

Mr. MAILLOUX: I had recently occasion to experiment with various forms of batteries while conducting some researches with the new exciting liquid which has come into the market lately under the name of "coquimbite," and while experimenting with it, I had occasion to use some batteries which are made in Philadelphia by Partz, called the Partz acid gravity battery. It is a square cell in which the carbon is placed on the bottom. The carbon has a corrugated surface. He has one form which is simply a zinc, as in the gravity cell. In the other form, he has a porous cup with the zinc inside, and I have found that when the liquid was at the lowest specific resistance possible, the total resistance of the cell, carefully measured, was as low as $\frac{1}{100}$ ohm, and consequently anybody might think that you might obtain a very large volume of current; but unfortunately as soon as you close the circuit you find that there is only a very small current, comparatively speaking. You may get between five and ten ampères; but even that not for a great length of time, simply because you have the counter-electromotive force of polarization which immediately reduces the available electromotive force. I am told they are using these batteries with great success for dental purposes. They generally run them in series of three or four, and do not ask such a great rate of current of them and depend upon greater electromotive force to get the greater number of watts necessary. The cell is certainly a very convenient one, so far as construction goes, because it is so made that it will run without care and comparatively very little attention for months. I have not carried out my experiments with the battery with the Partz solution, and consequently I cannot tell how long it will last; but it occurred to me that it was a very convenient form of cell particularly for in-door use, office work and places where the battery is to be tried for a certain length of time and where it is desired to have a battery that does not require much looking after. I succeeded in getting four ampères out of a coquimbite solution, and I was led to reason from that that possibly the other would give a higher current and I think that some party I have met told me that Mr. Partz himself was using them a great deal for motors where the current continuously was from two to ten ampères.

Mr. CURTIS: Dr. Partz tried it in my office and it would not maintain more than three.

Mr. MARTIN: This whole motor question resolves itself into a question of current. If once we have the motor, as we have, the question comes, where shall we derive the current to drive it? It is very apparent, I think, from this discussion, that the day of the primary battery in driving motors is not a very long one. Where shall we get the current then? We can get it largely from

† See ELECTRICAL WORLD Record of Patents, Feb. 12, 1887.

the arc circuits; we can get it from the incandescent circuits. There are 700 to 1,000 motors on arc circuits and a great many on incandescent circuits. Mr. Sprague, for instance, has a large number of small motors in Boston, 25 or 30 at least running on the Edison three wire system. But in order to put motors into residences and have them running when people want them, you want to have a current that is available all day long in a great variety of places. Hence, to get that current, it seems to me we must in the last resort fall back on the secondary battery.

Mr. MAILLOUX: There are very many features about small motors worthy of a great deal of attention; one is the efficiency of small motors. We have all been educated somewhat to look at the efficiency of a small motor as being necessarily low, but that is simply because we have not learned to dissociate the various factors of efficiency. We must first determine what we mean by efficiency, whether we shall indicate by that term the absolute efficiency of the machine or merely its efficiency to convert mechanical energy into electrical energy, or *vice versa*. The point I wish to emphasize particularly is this: That while a motor may be very small and have a very small mechanical efficiency, a small co-efficient of conversion, that is to say its power to convert electrical energy into mechanical energy, may be comparatively small when compared to a machine of much larger dimensions, yet the total efficiency may still remain at quite a respectable figure. That is, that when used as a generator it would convert a small proportion of energy of one kind into energy of another; but the total efficiency is not affected by that; it is the product of the electrical efficiency in the circuit and the efficiency of the machine itself. Consequently, if your motor efficiency is lower then you have only to raise the electrical efficiency in order to have still a total efficiency which shall be equal in any case. In saying this, I have reference more particularly to tests made by various authorities, such as Ayrton and Perry, Prof. Anthony and Lieut. Duncan, and others, in which they have shown very low total efficiency for small motors. I think in some cases as low as 13 per cent. of the total energy, and in no case above 50 per cent. was shown. Now I have believed that they were not giving the motor a fair show. The instrument from the necessary complications and limitations of its construction, it being of a small size, would be a very poor instrument to convert energy, so that its own co-efficient of conversion would be very low. Yet, although its efficiency may be very low, the efficiency of the circuit is entirely independent, and that is the ratio of the total amount of work being done. It is a function of the total amount of work that is being done in any case. In any electrical circuit the efficiency of energy transmitted varies as the counter electromotive force. It is a ratio of the counter-electromotive force to the total electromotive force. Let us suppose that this machine when used will transform 80 per cent. of the mechanical energy applied to it into electrical energy. Let us suppose, further, that 90 per cent. or 95 per cent. of that will be useful in the external circuit; so we have a total co-efficient of useful conversion of .80 times .95, which is 76 per cent. Now that is the co-efficient of conversion so far as useful effect is concerned. Then let us suppose that we have a battery so arranged that it will allow this motor to run at as high a speed as possible and that we get the power out of it when it is running at 1,500 revolutions. Let us suppose that the current is as small as is consistent with getting the power.

Mr. CURTIS: Excuse me. It is the resistance of the motor that determines that thing.

Mr. MAILLOUX: Not necessarily.

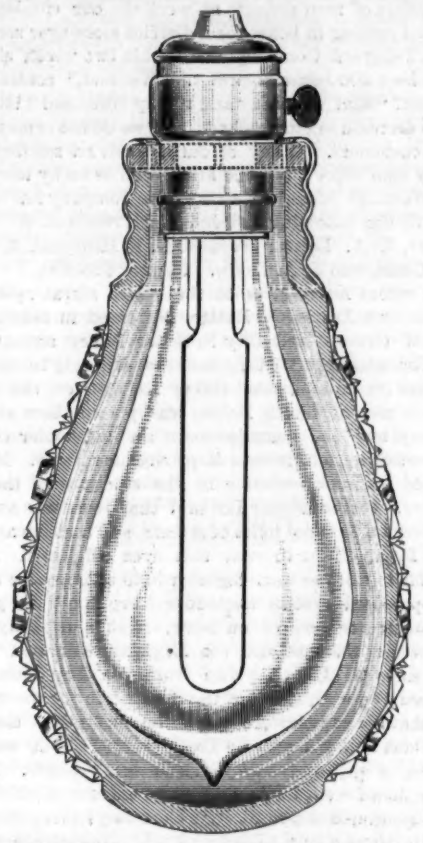
Mr. CURTIS: You are running your counter up just as near your direct as you can. Now it is that resistance that determines the amount of current.

Mr. MAILLOUX: No; it is the total electromotive force you are using in the first place. If you are using a large total electromotive force, then your motor can give a higher electromotive force; consequently it will develop a larger counter-electromotive force, and the ratio of the two would be large. Now, the total work that will be given to that motor may be anything you please. Let us take the case of the Edison circuit. This machine can be wound so as to give comparatively a high counter-electromotive force, and we can make the ratio as high as we please and get the same power with a much lower current, and I find he uses a current of $\frac{5}{10}$ ampère. Now this would show that the counter-electromotive force of the instrument would be a higher ratio, and we may easily see that you cannot get 90 per cent. electrical efficiency. In other words, the amount of the electrical energy that is required to transform the energy of the moving part in proportion to the amount that is absorbed in it is the ratio of counter-electromotive force. Therefore the electrical efficiency will be anything you please, according to the speed with which the motor is run. Therefore the total efficiency will be .76 times .90, which is a little over 60 per cent. That is what I mean to say—that although this may have a very low conversion, yet by raising its electrical efficiency we can raise the commercial efficiency.

Mr. CURTIS: What is called commercial efficiency is the same thing as what you mean, taking into account the external and internal resistance in the machine. Take an ordinary dynamo machine; it does not affect the converting power, whether it has a high internal resistance or a low internal resistance. In regard to the amount of current that it is necessary to supply it with in order to obtain a given power, that element is of no importance at all; nobody cares what the internal resistance is. The only trouble about having high internal resistance is that it absorbs the power, and then it prevents self-regulation. There is a great deal of talk about commercial efficiency. The most important thing is just the converting power. If you put 100 volts and $\frac{5}{10}$ ampère on that wire, then put on the friction brake and take out the foot-pounds, the proportion of friction that goes out to the ampères that go in gives the important thing as regards efficiency. The other important thing is how many dollars worth of ampères it takes to give an eighth of a horse-power or a tenth of a horse-power or two horse-power, whatever you want.

Mr. WETZLER: I rise to a point regarding the efficiency, not theoretical, but in a practical sense. I would like to call attention to a fact in regard to the construction of the armature of a motor. I am acquainted with a very well-known electrician who had started out to make a small motor of large efficiency, one which should approach the efficiency of the larger motors. He started out with a solid armature of the Siemens type. He got, I believe, 15 or 20 per cent. He tried all sorts of winding, etc. It occurred to him that it might be well to laminate that armature, which he did to a certain extent, and he obtained 10 to 20 per cent. more efficiency. He kept on increasing the number of his laminations until he reached 60 per cent. Consequently I would like to point out that the efficiency of a small motor must be looked for to a considerable extent in the lamination of the armature. I see in the armature before me that the attempt has been made; but it strikes me that it could be improved upon, if the suggestion is allowable. It seems to me that there may be some chance of the current getting across these sections.

Mr. CURTIS: We made one test. We mounted one of those rings on a wooden block, without any winding on



INCANDESCENT LAMP RADIATOR—SECTIONAL VIEW.

the armature, and ran it at a high speed, and we found that whether you turned the field on and off or not, that is, whether it was revolving in the magnetic field or not, made only a very small difference, and was that with an armature in which the laminations were only half as thin as they are there.

Mr. WETZLER: You had no windings on that at all.

Mr. CURTIS: No windings.

Mr. WETZLER: You cannot say, then, that the conditions were exactly alike. Did you ever try a solid core with your actual windings on it? That would be a crucial test.

Mr. CURTIS: No; that would be so vastly different from a solid core. Until you get up to a certain point the efficiency runs up very rapidly. Beyond that point the Foucault currents are so small that it does not pay to carry them much further. We considered the thing very carefully and I do not believe that there is over five per cent. lost at the very outside, by Foucault currents.

Mr. WETZLER: You will also remember that some time ago Mr. Mordey pointed out distinctly that the loss in the motors was due to that very cause, the Foucault currents. There is another point I want to bring up, and that is, do not you gentlemen consider it advisable to have some arrangement for reversing the motor? For many

ELECTRIC LIGHT HOOD.

applications it is desirable that the motor should run in the opposite direction.

Mr. WHEELER: Do you mean momentary reversal?

Mr. WETZLER: To run a machine in either direction.

Mr. WHEELER: You can do that; you can change the field connection for one thing.

Mr. WETZLER: I mean to have your motor on your lathe or work-table, and be able to turn a switch or any other mechanism and have the motor run in the opposite direction.

Mr. CURTIS: We have not had any demand yet for such a machine, and the principal purpose that has occurred to us for that kind of thing is for use on a boat.

Mr. WETZLER: I can see very well that there would be more than one application for that kind of motor. For instance, a dental lathe would want to be reversed.

Mr. MARTIN: I have had dentists ask me if I knew a motor of that type.

Mr. CURTIS: One point about these brushes is that they are arranged so that the armature can be turned in either direction without destroying the brush.

Mr. PENDLETON: I had some years ago a surgeon of this city making some experiments with an osteotome in my laboratory for the purpose of testing the power to be received from an accumulator, and for that purpose he brought down with him tibiæ, feet-bones and so forth, and had his little saw attached to his surgical instrument which operated very satisfactorily; at least he said that he had never been able to get such results from any primary battery, and he had spent several thousand dollars in trying to perfect a system suitable for his purposes. I noticed that his instrument got upon a dead point several times and I asked him how it was. He said it was the best he could find. I then furnished him with a motor which has attracted some little attention, although it has never been put on the market to any extent. I have received letters from Paris in regard to the cut of it which was published by THE ELECTRICAL WORLD some time ago. That little motor fulfilled its purpose and it was simply the commutation of two brushes upon a three-pole armature with the usual circuit, so that there was a continuous current through the two circuits of the armature, and the polarities gave on the three-pole armature all the attraction and repulsion that was capable of being derived. I finally conceived that it would be a benefit to use discs of thin iron, and my experience in the matter fully coincides with the remarks made here to-night. There was an efficiency of at least 25 per cent. merely from replacing the cast iron by the wrought iron. In regard to the loss by Foucault currents mentioned, this ring traveling in the periphery of the armature would not suffer from Foucault currents as much as the ordinary armature which is placed directly upon the shaft and having the speed of the periphery so much higher than the iron nearer the shaft. In that respect I should hardly think that 65 per cent. would be an overestimate, whereas in the ordinary H armatures it would be much greater. In regard to insulation, an insulation by peroxydizing this iron might be sufficient, instead of taking up the space with paper. These little motors are now becoming very interesting and their importance will be appreciated so soon as we can get the current to introduce them generally, and when the time comes do not forget that the secondary battery will be a most valuable apparatus to regulate and govern these motors and economize at the same time the power which would be lost in any other method of governing.

An Electric Light Radiator.

The electric light is an illuminant that lends itself in a special manner to ornamental effects, and its increasing use in the incandescent form in homes and interiors, has greatly stimulated the production of devices intended to enhance its beauty or to obtain some new decorative result. We illustrate on this page a device that has, we are free to admit, won our hearty admiration. It is a flint glass radiator globe made in two pieces and richly cut. The parts are secured together at the top around the socket, in the manner shown in the view cross section. This not only renders the plain and unpretentious little bulb a brilliant ornament, but it serves to soften without materially lessening the light. The radiator is made by J. Hoare & Co., of Corning, N. Y. The firm have also now made a spherical radiator of molded glass, quite as pretty as the cut glass, but costing only about one-sixth as much. The globes are provided with means for ventilation, and being in two pieces are easily handled in putting on or taking off. When on, they form practically a part of the lamp itself. They can, of course, be made to any shape of globe or candle-power size.

Electric Light Hoods.

The question of combined protectors and reflectors for electric lamps, especially when in use for street lighting, has received much attention from manufacturers, and the comparative merits of glass mirrors, polished metal, and pure white surfaces as reflectors have been thoroughly canvassed. As the main requirements in articles of this class are of necessity low cost and durability, and as neither of the first two materials will answer these, all hoods for ordinary use reflect from an inside surface of hard-baked white japan (not paint). This is the most satisfactory reflector, consistent with the low price asked, that has yet been found, and its enamel-like qualities, not obtainable with paint, enable a hood so coated to withstand the vicissitudes of the weather without cracking and peeling off, or even losing its pristine lustre.

As to the shape of the hood, the best for most purposes is the conical, not only in that it protects completely the lamp inside, but because it tends to dissipate the heavy shadow of the bottom plate upon the ground, which probably causes more grumbling among the laity than any other feature of the electric light, except its total extinction.

Of the makers who have worked steadily to improve the forms and finish of hoods, and at the same time to decrease the price, we may mention Mr. J. S. Watt, who has the best facilities for the work, and a visit to his place discloses the secret of the large business done by him in this line. Almost the entire process of manufacture is seen—the cutting out of the heavy galvanized iron (this maker not using tin, as being less durable), the riveting, wiring the edges, fitting the ornamental cap and the inside lugs, and finally the two coatings of japan and the consignment of the hood to the baking oven.

It Doesn't Mean the Passengers.—In the engineer's room on the cars of the Suburban Railway Company, the following notice is conspicuously posted: "Engineers must oil travelers every three hours." The sign in question causes many inquiries from people riding in the cars, and to settle the matter definitely and set at rest the minds of many people, it may be well to state that the word "travelers" has no reference to passengers who ride in the cars, but to the little arrangement that runs on the wire above the car and which conducts the electricity to the motor.—*Scranton Republican.*

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Feb. 14, 1887.

Mr. A S. Hibbard, the active young superintendent of the American (long distance) Telephone and Telegraph Company, 15 Cortlandt street, announces the completion of the lines between New York and Philadelphia, Camden, Stamford, Norwalk, Bridgeport, Birmingham, Ansonia, New Haven, and various Connecticut points, by means of which the telephone subscriber in New York can talk with those in the other exchange systems. Three classes of service are offered—complete metallic circuit connections; metallic circuit connections at one end, and local grounded circuits at both ends. The special rate for the long distance outfit of apparatus is $5 a month. For the five minutes' talk business, the rates range from 50 cents to $1 between 8 A. M. and 6 P. M., and a general rate of 50 cents applies to all business between 6 P. M. and 8 A. M. The outlook for this new development is most promising. The public is already evincing its appreciation in a very marked manner.

The Edison Electric Light Company has issued a circular, with regard to the new wire gauge given in THE ELECTRICAL WORLD of Feb. 5, to all its sub companies, constructors, contractors and others interested in the lighting business. The circular states that the Company has adopted the Edison gauge as its standard, and it requests all concerned to have conductors drawn to that gauge hereafter. It states also that the Ansonia Brass and Copper Company, Washburn & Moen Manufacturing Company, Holmes, Booth & Haydens and the Electrical Supply Company have agreed to furnish copper conductors according to the gauge. In view of the large amount of work done by the Edison Company, it is evident that this action must have an important effect.

Brooklyn is becoming more and more a good manufacturing centre, and is favored by a number of electrical concerns. One of the new enterprises recently started is the Mutual Electric Light Company, whose works are at the corner of York and Washington streets. Mr. Theodore E. Otis is the president and general manager, and the electrician is Mr. E. R. Knowles, one of the best known and most promising of the younger school. A specialty of the Company is the furnishing of lighting plants of the Knowles system to cities and towns buying outright. The company has good lamps and machines with several important improvements, and will, it is understood, pay some attention to the new motor business. It has also an excellent thing in the Knowles automatic fire alarm system, designed to protect houses stores, etc., by providing means whereby outbreak of fire at any point is registered at a central office, and warning is given at fire stations. The system includes a visible signal indication box located in the building, and this indicates the floor, while the alarm goes into "central." Various parts of the system, as well as the general principle, are quite novel. Altogether the company, composed as it is largely of active and able young men with influential backing, has a bright outlook. The New York offices are at 20 Nassau street.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Feb. 14, 1887.

An arrangement has been completed at Portland, Me., by which the Atlantic Telegraph Company has been leased to the Baltimore & Ohio Telegraph Company for a term of years. This was brought about, it is said, by Hon. John W. Deering, president of the first named company. One of the Portland dailies, editorially commenting upon the arrangement above referred to, says:

"Already it is claimed that the Atlantic Telegraph Company has saved to the people of Portland between $3,000 and $3,500 in telegraph tolls, and the new arrangement insures to the people of Maine for all time the continuance of the Atlantic as an opposition company.

"This arrangement will make it impossible for Western Union to ever gain control of what will soon be a great opposition line. The Baltimore & Ohio proposes to extend the Atlantic lines through to Bangor, touching at all important points, and thence to Halifax. This extension will be made in the early spring, and the Atlantic will compete with the Western Union at points where the Western Union never had a rival before. Beside this great extension of the Atlantic lines from Portland to Halifax, the Atlantic lines will be extended through New Hampshire to Manchester, Concord, Nashua and Keene. The Baltimore & Ohio will also shortly announce a further reduction in rates for Portland business."

The trouble which has been brewing for some time past between the Baltimore & Ohio Telegraph Company and the Boston District Messenger Company, owing to unsatisfactory service performed by the latter in the capacity of delivering messages for the former, culminated on Tuesday, Feb. 8, in a crisis. The District Company cut its wires out of the B. & O. offices and connected them with the United Lines office. On the same evening General Superintendent E. A. Leslie, of the B. & O. Company, arrived from New York, and in conversation with a group of newspaper and telegraph friends, said:

"Well, there has been trouble between the two companies for a long time, as we were not satisfied with the service performed. Monday I received a telegram from the manager of the District Company announcing that his company would do no service after Monday. This was the first and only notice we had, and, of course, it surprised us. This morning we found that they had cut their lines out of our office and diverted them to one of our competitors. This was in direct violation of our contract, which was for five years, only three of which have elapsed. To-day we laid the case before Judge Holmes of the Supreme Court, and he has summoned the District Company to appear before him Wednesday morning to show cause why he should not place a temporary injunction upon them to restrain them from removing those wires that remain, and compelling them to replace the wires they have cut out. Of course this will cause our patrons some inconvenience for the present, but we shall do our best to remedy matters speedily and indeed improve them. I have had interviews with several of our more important patrons, and they have unanimously expressed their willingness to put up with poor service for a few days. We have fully determined to have nothing more to do with the Boston District Company, and soon shall have better service for our patrons than ever before."

On Wednesday, Feb. 9, the officers of the telegraph and messenger companies, with their respective attorneys, met before Judge Holmes in the Supreme Court room. The case was postponed until March, when it will be tried upon its merits. It is authoritatitively stated that the B. & O. Telegraph Company has entered suit for $20,000. In an interview on Feb. 11 with an officer of the B. & O. Company, the statement was made to me: "Two gangs of men are now at work in our employ, stringing wires and putting in boxes for a district messenger service for the B. & O. Telegraph Company, and within two weeks' time we shall have at least 200 boxes in circuit. We find," continued my interlocutor, "that yesterday and to-day (10th and 11th) there has been no decrease in our business; and we do not expect to lose any of our customers. Many of our friends are sending their messages by their office boys, and others call us up by telephone."

The Westfield (Mass.) Electric Light Company has been organized with the following officers, viz: President, W. A. Chase; treasurer, J. A. Lakin; directors, A. E. Hemphill, A. G. Magna, W. A. Chase, and J. A. Lakin. Capital $25,000.

At a recent hearing, as to the police signal system, Augustus Russ and Lewis G. Farmer appeared in behalf of a committee of citizens, and City Solicitor Bailey appeared for the city. Commissioner Whiting said that it would be more than an equivalent for an additional 100 or 150 men on the force. The system in use at South Boston was placed there at no expense to the city, and the commissioners are not under obligation to purchase that system in case it proved favorable. Mr. Whiting submitted testimony relative to the efficiency of the system in Baltimore. Commissioner Lee said that there was an average of one policeman to three miles of streets, and that it was utterly impossible for an officer to cover this area efficiently. It would be impossible to call the force together in less than three hours. Under the proposed system the whole force could be got together within three-quarters of an hour, fresh and ready for work. Commissioner Osborne said the Legislature deemed it expedient to take the control of the police from the City Council, and the board had now a right to test the matter in the courts. He suggested that the expenditure might be met out of the money received from liquor licenses. Last year, $110,000 was collected in excess of any previous year's license receipts. The system could be introduced, he thought, at an expense of $150,000.

The Thomson-Houston Electric Company has recently furnished to the Hartford (Conn.) Electric Light Company apparatus for 300 incandescent lights, and the demand for illuminants of that kind is so great in the city named that this order may be considered as simply the advance trumpeter to a much larger number.

W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Pa., Feb. 14, 1887.

The Keystone Electric Light and Power Company, whose office is at 108 South Sixth street, are installing a 150-light Westinghouse plant in the large mill at American and Dauphin streets, owned by Messrs. Irvin & Corby. This plant is put in by the owners of the mill as part of the machinery, in the same manner as the steam engine, and will be operated by the lessee of the mill. This is an example that it would be well for more mill owners to follow. The company have just started up the plant of Henry Warden at Germantown Junction, using eight 150 candle power lamps in the boiler and blacksmith shops, and 75 16 candle-power lights placed about the different machines. The dynamo is of 150-light capacity, and is driven by the 25 h. p. Westinghouse engine, which also drives the 12-foot fan for heating and ventilating purposes.

Mr. H. E. Swift, formerly of the firm of Swift & Smith, Attleboro, Mass., has charge of the new factory of Vallee Bros. & Co., at 932 Arch street, where the manufacture and sale of electrical and pneumatic supplies is carried on.

Mr. W. A. Giles, well known to many of your New York readers, is at 250 Chestnut street, representing the Philadelphia Automatic Fire Alarm Company.

The business of the Pinkham Electric Gas-Lighting Company will be continued by Horace A. Pinkham, as before, at 1018 Chestnut street, the old partnership having been dissolved. In the same manner, the business of the Cleverly Electrical Works will be continued by Henry A. Cleverly.

Mr. W. C. Crandell, 49 South Fourth street, manufacturer and dealer in general electrical supplies, makes a very fine door pull, as well as window springs, iron frame and box bells, etc. He gives special attention to model work, experimentation, and machines to order.

Dr. Otto Flemming, 1009 Arch street, Philadelphia, well known in the medical battery field, has lately invented a new ozone electro-medical instrument for purifying the atmosphere in sick rooms, etc., and for use in nose and throat troubles, catarrh and the like. It is composed of a large spark coil, the poles of which enter a long tube 1¼ inches in diameter, with pointed discs for the spark. The air is forced through the tube by means of a small fan run by ingenious clock-work. At the end of the tube is a mouthpiece, by which one can inhale the ozonized air as it leaves the machine. The apparatus is all enclosed in a fine walnut case, 12½ inches long, 5 inches high and 7 inches wide, and has highly-finished nickel or silver fixtures.

The Electro-Dynamic Company, 224 Carter street, W. W. Griscom, president, and L. P. Paul, general manager, are very busy putting out electric light plants in connection with the batteries of the Electrical Accumulator Company of New York. One of the features is the storing in the day time, with a minimum engine capacity, and then "drawing off" any current required, at night, with perfect uniformity and steadiness of supply. There is more in this development than our philosophy dreams of to-day.

Dr. S. H. Guilford, dentist, of Philadelphia, has used the Partz acid battery for one year, on intermittent service, with his dental mallet, and the same battery can now be seen at the Partz Company's office 1723 Chestnut street. The zinc and carbon are so clean as to give one the idea that they belong to a new cell.

Gill & Murray, the large makers of colored glassware, globes, etc., York and Thompson streets, are filling some very large orders in electric light globes, and have lately shipped large quantities through the West. The opal glass produced by this concern gives a beautiful mellow light, such as is specially needed in electric lamps, in stores and busy interior spaces. The firm extend an invitation to members of the electric light convention to call and inspect the factory for themselves. Such a visit will be found very instructive.

The Cleverly Electrical Works have just issued an extremely neat card giving the new code of weather signals as adopted by the government, to go into effect March 1 this year. It will be remembered that the Works have a card already out showing the more familiar signal flags used up to date.

Shaw & Geary report a good trade in their new vibrating burner, with which they propose to displace the old jump spark burner. The firm have several new electrical specialties in window springs, burners, etc., shortly to be put on the market.

The following note from a local publication about a well-known house will be of interest.

"Partrick & Carter are manufacturers and dealers in electrical supplies for the telegraph, telephone and electric light; sole proprietors of patent needle annunciators and burglar alarms, No. 114 South Second street. This house was founded in 1867, the co-partners being Messrs. James Partrick, Franklin S. Carter, Chas. M. Wilkins and E. Ward Wilkins, all of whom are expert electricians and possess an intimate knowledge of the wants and requirements of the trade. This firm has been for the past sixteen years the leading one in this country for telegraph and electrical supplies, and the immense patronage which has been bestowed on its goods has induced the partners to greatly increase their already extensive manufacturing facilities. Messrs. Partrick & Carter guarantee their annunciators, electric bells, etc., to be of the very best workmanship and materials, and to possess points of superiority that place them far in advance of the productions of any other manufacturers. The firm calls special attention to its patent needle or pointer annunciator; it is without a rival as to simplicity, quickness of action and all qualities that constitute a first-class annunciator. These alarms and annunciators are made of the best materials obtainable. The magnets are covered with the best insulated pure copper wire—not the bare wire glued on, as is used on some of the magnets of the so-called cheap annunciators—and the indications or numbers are painted on the dial and then gilded, not merely printed pieces of paper stuck on with gum. The needle or pointer of steel is pivoted directly to the dial-plate, and is attached to no inside complicated mechanism as is the case with the majority of the so-called needle annunciators. The great popularity of these famous annunciators has induced several other manufacturers to try and imitate them, but in all cases they have failed entirely, the general appearance of the imitation being similar in outside effect but entirely different in the interior mechanism. These annunciators are fully covered by letters patent of the United States. The firm likewise produces extensively electric thermostats, chlorine and Leclanché batteries, electric gas-lighting apparatus, electro-platers' supplies, electrical novelties, electro-medical apparatus, experimental apparatus and everything pertaining to electricity. These specialties are absolutely unsurpassed for workmanship, quality and general excellence, and are the best in every particular ever offered to the public. The premises occupied are very spacious, and consist of a five-story building admirably arranged and equipped with all the latest improved machinery and apparatus necessary for the systematic conduct of the business. A large number of experienced mechanics are employed, whose operations are all conducted under the careful supervision of the proprietors, who are sedulously engaged in maintaining the character of their manufactures, and thereby meeting the most exacting demands of a critical trade. Messrs. F. S. Carter, Chas. M. Wilkins and E. Ward Wilkins, the present proprietors of this establishment, are highly esteemed by the community for their scientific ability and inflexible integrity, and have gained a prominence in the manufacture of electric supplies which is accorded only to those firms whose operations are conducted on the enduring principles of equity. Messrs. Partrick & Carter publish illustrated catalogues of their goods, which can be had on application."

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Feb. 12, 1887.

It is expected that after the 1st of May the Lake Shore drive, or some portion of it, will be lighted by electricity. The Lake Shore Electric Light Company has been incorporated for the purpose, and its incorporators are Robert T. Lincoln, W. G. Beale, and E. P. Prentice. In speaking of the matter, Mr. Lincoln said: "A few of us who have built or propose to build houses along the drive have come to the conclusion that we may indulge in the luxury of electric light. I cannot tell how much of the drive will be lighted, but I am of the opinion that by next winter the entire thoroughfare, from Oak street to Lincoln park, will be illuminated. I cannot tell where our plant will be located, but we expect to push matters as rapidly as possible."

Ernest M. Brown, an employé of the American District Telegraph Company, while lighting a fire in the Twenty-second street office early the other morning, threw a burning paper on a can of coal oil, which exploded, badly but not seriously burning the young man's face.

On Monday evening an ordinance was introduced in the Chicago City Council by Ald. Dixon authorizing the Western Edison Light Company to construct and maintain in the streets, alleys and sidewalks lines of wire to be used for transmitting electricity for light, heat or power. The company is required to lay its wires under ground, and to supply electricity on any street where ordered by a majority of the city council. The ordinance was referred to the committee on fire and water.

When in St. Louis a few days ago, I visited the extensive ironworks establishment of Mr. George J. Fritz, at 2026 South Third street. I have used the word "extensive" with a full realization of its meaning, for these works cover nearly an entire block, and contain some of the finest machinery of the kind required, to be found under one roof in the West. The works were established in 1874, and at first only mill-gearing and supplies were manufactured; to-day, however, more than a score of different but kindred products are turned out. I will not attempt to enumerate

all these articles of manufacture other than to say that among them are comprised steam engines, doctors, pumps, shaftings, pulleys, hangers, brass goods and belting. Mr. George J. Fritz, himself a thoroughly practical mechanic in the very prime of life, gives personal and minute attention to all the details of his large shops, and his name on a piece of machinery is a guarantee that it has been honestly manufactured and carefully inspected. Electric light men will be especially interested in an engine of Mr. Fritz's invention and manufacture, which is constructed with special adaptability to dynamo use. There are 128 of these engines in use in St Louis alone, and perhaps three times that number in other parts of the country. Some late orders received by Mr. Fritz are as follows: 12 h. p. engine and a 42″×96″ vertical boiler, pulleys and shafting for A. F. Miller's new lightning rod factory, St. Louis; 4 h. p. Fritz patent engine, with boiler combined, for Thomas Dixon, Townsend, Mon.; 4 h. p. engine, to Meyer Bain Manufacturing Company, St. Louis; 4 h. p. engine and boiler combined, to American Mineral Spring Water Company, St. Louis; 4 h. p. engine and boiler combination, Los Angeles, Cal.; an 8 h. p. Fritz engine with a 10 h. p. boiler combined, to John Krey, St. Louis; a 2½ h. p. engine and boiler combined, to J. Schiller, Pine Bluff, Ark. Mr. Fritz publishes a large and finely illustrated catalogue, which he will be pleased to mail to applicants.

For the sake of the figures mentioned I give below an extract from the Vincennes, Ind., *Sun*. It will be remembered that the Vincennes Electric Light and Power Company uses the Heisler system: "With the introduction of electric light comes justice to many of our taxpayers, who have for nearly thirty years been paying their full share for street light and never received one ray. Though long delayed, this simple act of justice will be none the less appreciated. Their property will be enhanced in value and they will enjoy all the comfort, convenience and safety that light affords. But not only this—these people, so long in darkness, will have a more steady, brilliant, beautiful and modern light than those in the gas district, which will be some recompense for their long waiting. Still another satisfaction to them will be the fact that their new (electric) light, though better in many ways than gas, will not cost the city quite one-third as much as would gas distributed over the same extent. Gas to light up these 100 intersections would cost the taxpayers at the rate of $7,200 per annum, for gas alone, while the city would have to pay near about $4,000 additional to that sum for gas-posts and gas lamps. For all this service, furnishing posts and lamps free to the city, the Vincennes Electric Light and Power Company receives but $3,400 per annum. Besides these advantages, all our citizens, since the first day of January, have enjoyed a reduction of 20 per cent. on their gas bills, because of the healthy competition that was assured by the electric light organization. Our gas consumers all frankly admit that their bills this year have been smaller than ever known before in the history of the two gas companies that have existed in Vincennes."

Licenses to organize the following companies have been issued by the Illinois Secretary of State: The National Improved Pan-Electric Telephone Company, of Chicago; capital stock, $10,000; incorporators, K. Morgener, George S. Bowen and Lyman E. De Wolf. The Lake Shore Electric Light Company, at Chicago; capital stock, $10,000; incorporators, Wm. G. Beale, E. P. Prentice and Robert T. Lincoln. Also a certificate to increase the capital stock of the Electric Illuminating Company, at Chicago, from $25,000 to $50,000.

The Lima, O, Street Railway and Power Company has given an order to the Van Depoele Company for the equipment of a three mile electric road. There will be six cars, with a 10 h. p. motor on each. A 60 h. p. generator will be placed in the large electric light station. The three miles of track to be equipped includes the old line, and the new road laid with the Johnson steel rail, and runs through the heart of the city. The contract for the cars has been let to the Pullman Company, Chicago. Mr. B. C. Faurot is the leading spirit in the enterprise.

The Western Electric Company's big engine is now running 21 hours a day, so pressed with orders is the concern. The electric light, multiple switch-board and Patterson cable departments are especially busy. The Ohio Valley Telephone Company, of Louisville, Ky., have just placed an order with the company for two additional sections of multiple switch-board. This brings General Manager Gifford's equipment up to eighteen hundred lines. Another multiple switch-board order is for Columbus, O., with an equipment for twelve hundred subscribers. In addition to the above the Western Electric Company have just received orders for the following electric light plants: 90 arc lights and 100 incandescents for the new dry goods house of Lowenstein Bros. & Company, Memphis, Tenn.; 40-light plant for Winfield, Kansas; 180 lights for the Town of Lake (Illinois) Gas Light Company. This last mentioned order is an increase, and when these 180 lights are installed this plant will consist of 350 Western Electric lights.

I have the following from Mr. W. W. Cantine, secretary of the Alliance (O.) Gas Light Company, with a request for its publication: "A report seems to have been circulated that we are proposing to change our electric lighting system; in consequence of which we are receiving letters from all the numerous electric light companies. As we cannot take the time to reply to all of them, we request that you make public the fact that we do not intend to change from the Western Electric system of lighting, which has been fully satisfactory to us in every way. We are about to increase our plant, and this may have given rise to the report above mentioned."

From present appearances, I judge the western contingent will be well represented at the Electric Light Convention.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following telephone stock quotations:

Bell of Mo.	$155@$157
Chicago	375@ 400
Central Union	49@ 50
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 38
Iowa Union	16@ 19
Michigan	71@ 78
Rocky Mountain Bell	40@ 45
Wisconsin	104@ 106
United	18@ 20

W. A. K.

THE TELEGRAPH.

The New York & Chicago Telegraph Company is proposed, its object being to do special private line work between the two cities, using a 40-wire cable.

Extending Its System.—The Baltimore & Ohio Telegraph Company will, at an early day, it is said, extend the system through the Southern States, covering all points now reached by the Western Union Company.

The Reading Railroad Telegraph Lines.—The New York *Tribune* says that the Western Union is likely to operate the Reading telegraph lines, as Mr. Corbin joined the Western Union directory at the last meeting.

The French Cable Soon to Begin Business.—President Green, of the Western Union Telegraph Company, has not yet replied to the demand of the French Cable Company for the surrender of its land lines. In the meantime the new superintendent of the French company has been refitting and furnishing the rooms upon the main floor of the old telegraph building at No. 8 Broad street. The wires have been put in, and Mr. Fisher says that the new office will be ready for business at a day's notice.

French Cable Repairs.—Superintendent Fisher, of the French Cable Company, has chartered the steamship "Ulunda," of Halifax, for use in repairing the break in the cable near St. Pierre. An expert will arrive at Halifax on the steamship "Sardinian," with grappling appliances and other tools for repairing the cable, and it is thought that it will not be necessary to send for the repair ship of the French company. After the arrival of the expert Mr. Fisher thinks that seven or eight days will suffice for putting the cable again in working order.

THE TELEPHONE.

A Novel Litigation.—General Barney, in his Telephone Bulletin, says: A case involving some novel features in telephone litigation has recently been decided in New Orleans. On the night of Oct. 24, 1885, the steamship "Alva" dropped its anchor upon a cable belonging to the Great Southern Telephone and Telegraph Company; and in raising the anchor the next morning the cable was cut and destroyed, causing an alleged damage of $2,500. The officers of the vessel had previously been notified of the fact that the cable was fouled with their anchor. On the 13th January the Court rendered its decision against the telephone company and in favor of the steamship, on the ground that the vessel was in charge of the pilot who brought her up from the Passes, and that he caused her to be anchored, and that the owners and officers of the steamer were in no way responsible for the acts done to the cable.

Meucci Telephone Stock.—The stockholders of the Globe Telephone Company had a meeting last week, at the offices of their counselors, Humphreys, Gardiner & Humphreys, Nos. 31 and 33 Broadway. The Globe Company was organized in New York in 1883, and owns the inventions of Antonio Meucci. It was threatened with an injunction in this city some time ago, and to prevent it the stockholders organized under the laws of Tennessee, with headquarters in Philadelphia, as the Meucci Telephone Company, and many Philadelphians hold stock in the concern, Chief Engineer William Park, of the Philadelphia Gas Works, being one of the heaviest holders. It was decided at the meeting to transfer, in exchange, the stock of the Meucci Company to the treasury of the Globe Company, to be taken by the Globe Company members in the proportion of two shares of Globe for one share of Meucci stock.

THE ELECTRIC LIGHT.

Shenandoah, Pa., is to be lighted by electricity by J. S. Kistler and others.

North Manchester, Conn.—Electric lights are soon to be placed in some of the mills at North Manchester.

Plymouth, Mass.—Electric lights are being put into the tack and rivet works of Loring & Parks at Plymouth, Mass.

Trenton, Mo.—The Trenton Gas & Electric Light Company has been incorporated by G. Josselyn and others with a capital stock of $18,000.

Reading, Pa.—The Reading Electric Light and Power Company have set two new boilers with the Jarvis setting.

Southbridge, Mass.—An electrical light is to be put in at the American Optical Company's Works, Southbridge.

Somerville, Mass.—The Somerville Electric Light, Heat and Power Company has been incorporated by O. S. Knapp and others, with a capital stock of $25,000.

Norwalk, Conn., has contracted with the Norwalk & South Norwalk Electric Light Company for 50 lights at $100 per light, yearly, for two years.

The Acme Electric Company, of Tarrytown, N. Y., is manufacturing the Roe dynamos and lamps for arc and incandescent lights, and is paying special attention to mill and shop lighting.

Ann Arbor, Mich.—The Ann Arbor Thomson-Houston Electric Light Company has been incorporated by W. F. Dowdson, of Port Huron, and others, with a capital stock of $50,000. It is to be hoped that the company's circuits will not be much longer than its name.

Railway Cars.—The newspapers of the whole country are practically unanimous in demanding that, as one preventive of such awful railway accidents as have happened lately, all railway cars shall be lighted by electricity. This can be done in more ways than one, and the change should be begun immediately.

Newton, Mass.—At the last meeting of the Newton Board of Aldermen, a communication was received from the Newton Electric Light and Power Company to the effect that the company had established a plant, and was prepared to contract with the city to light certain streets.

A New York Company.—The Safety Electric Light and Power Company has been incorporated in this city. Its capital stock is $250,000, divided into 2,500 shares of $100 each. Its purpose is to manufacture electricity for light, heat and power. The trustees for the first year are Henry W. Kerr and Walter C. Kerr, of Brooklyn; George W. Jones, of New York; Caleb H. Jackson, of Pittsburgh; and Herman H. Westinghouse, of the same city.

The Fitchburg Steam Engine Company, of Fitchburg, Mass., has just fitted out and started a very satisfactory electric light plant for the Gas Light Company of Keene, N. H. It has also recently put in a 250 horse-power engine for the Brush Electric Light Company, of Boston, and a 150 horse-power engine for the Salem Electric Light Company, of Salem. It will soon start a 50 horse-power engine in an electric light plant in Boston, besides many others.

North Attleboro, Mass.—The North Attleboro Electric Light and Power Company have decided to enlarge their station and increase their power. The contract for this work has been awarded to the Jarvis Engineering Company of Boston. They will put in a 150 h. p. tubular boiler, set with the Jarvis boiler setting and Sheffield grates, also two 70 h. p. Armington & Sims Company engines to belt direct to dynamos. They will introduce the Sprague system of transmitting power by electricity, and intend to furnish power for an electric street railway.

The Enterprise Electric Company, of Friendship, N. Y., which has been doing a large business lately in furnishing electric light outfits, has been compelled to make an assignment through the very heavy losses in the Washington, Pa., oil field, of its president, Mr. S. A. Holbrook. The assignee is Mr. W. P. Clark, of Clark Brothers, Belmont, N. Y. The assets of the company are considerably in excess of the liabilities, and as soon as the affairs of the company can be settled up, it will be reorganized with ample capital.

APPLICATIONS OF POWER.

The Holroyd Smith System of operating street cars by electricity, now in use successfully at Blackpool, Eng., is offered for introduction in this country.

Mansfield, O.—From the interest evidenced in the Daft electric railway system, by the people and press, it looks as though Mansfield will soon have an electric road. The local *Herald*, of recent date, illustrates the Los Angeles road, and gives copious details of the working at Baltimore and elsewhere.

"The Electric Motor."—The sale of this book, published from the office of THE ELECTRICAL WORLD, has been unprecedentedly large, and the first edition is being rapidly exhausted. Some of the press notices will be found in our advertising pages. The interest felt in the electric motor is remarkably and significantly evidenced by the call for this work.

A Sprague Station for Boston.—The success of the Sprague motor in transmitting power over wires and running elevators, printing presses and other machines requiring from one to twenty horse-power, has created a demand for power for this system beyond the capacity of the present arrangements. It is said a Sprague power station will soon be started at the north end of Boston for furnishing power alone. By the use of the electric power system every loft in Boston can be made as available as the lower floors are now. Any one interested in this subject should visit the new store of Messrs. Peck & Hall, South street, Boston, where a freight, also passenger, elevator is run by electric power furnished from a steam plant over a mile away.

PERSONALS.

Mr. T. A. Edison, somewhat better in health, but attended by a professional nurse, has gone to Fort Meyers, Florida, where he will stay for some time, not returning North until the middle of summer. He hopes soon to be strong enough to take up some electrical experiments.

Mr. A. B. Uline, general manager of the Hudson River Telephone Company, has been re-elected Fire Commissioner of Albany. The term of office is for 5 years, and Mr. Uline has already served 5 years. Another remarkable feature of the case is that this is the first time a fire commissioner has ever been chosen unanimously in Albany. Mr. Uline is a public man whom to know is to admire, and he has our hearty congratulations on his successful re-election.

Mr. F. J. Sprague.—A correspondent in the navy writes us as follows: "I am very glad of Sprague's success, but it is not at all a surprise. I remember that during my first year at the Naval Academy, 1876-7, when Sprague was a second classman, a report was read out against him for working in the blacksmith's shop during study hours, and he got several Saturday drills for it. He had gone there, in violation of the regulations, to make a magnet. His report of, and work at, the Crystal Palace Electrical Exhibition are the most creditable that I know of in the line."

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

February 15, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	27	33
Am. Tel. & Cable	72	75
Cen. & So. Am.	95	100
*Com. Tel		
*Gold & Stock	90	95
*Inter. Ocean Tel.	90	95
N. Y. Mutual	71	
Pac. & Atl.	47	54
*Postal T. & C.	30	35
South. & Atl.	60	
W. U. Tel.	73¼	73⅝
W. U. Scrip.	61	
W. U. Bonds		119½
Mut. U. Bonds	84¾	85
TELEPHONE.		
Am. Bell	212½	213
Am. Speaking	110	120
Erie	27½	28
*Hudson River	60	65

TELEPHONE.	Bid.	Asked.
Mexican	1¼	1¼
*N. Y. & N. J.	89	93
N. Y. & Pa.		
New England	42½	43
*Southern Bell	110	130
ELECTRIC LIGHT.		
*Am. Electric		
*Brush		
*Brush Ill	100	
*Consolidated		
*Daft		
*Edison	200	220
*Edison Ill	105	110
*Edison Isolated		
*United States	35	50
*U. S. Ill	95	100
MOTOR.		
*Daft		
*Sprague		

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

MISCELLANEOUS NOTES.

Unscientific Teaching.—In a technical contemporary of deserved high standing, a series of articles on electric lighting has been begun. The readers are told that "for electric lights, dynamos are used, which give a constant supply of frictional electricity."

The De Montaud Accumulator.—Mr. E. T. Starr, of the S. S. White Dental Company, Philadelphia, writes us: "The electrical accumulator described in Feb. 5 number of THE ELECTRICAL WORLD as the De Montaud, is one of E. E. Starr's, who has an application for a patent in June, 1884, and was practiced by him before that time, to the knowledge of a number of reputable citizens, among them being Prof. G. F. Barker of the University of Pennsylvania. I wish only to give proper credit to the one to whom it is due." The battery in question is not commercially known in this country, but is being made and sold in France.

Storage Battery Litigation.—A bill of complaint was filed on Feb. 10, in the clerk's office of the United States Circuit Court in a suit which has been begun by the Brush Electric Company, of Cleveland, Ohio, against Charles D. P. Gibson, of this city, who manufactures and sells what is known as the Gibson storage battery. The suit is founded on the claim of the Brush company, that the Gibson storage battery is an infringement of the patents of the former. These patents were recently confirmed to the Brush company after four years of litigation in the Patent Office at Washington. This suit is said to be only the beginning of a general attack on infringers of the Brush patents.

BUSINESS NOTICES.

Coiled Wire Belting.—The Edison Machine Works have ordered over 1,000 feet this month from the Coiled Wire Belting Company.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting tools, etc.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED FEB. 1, 1887.

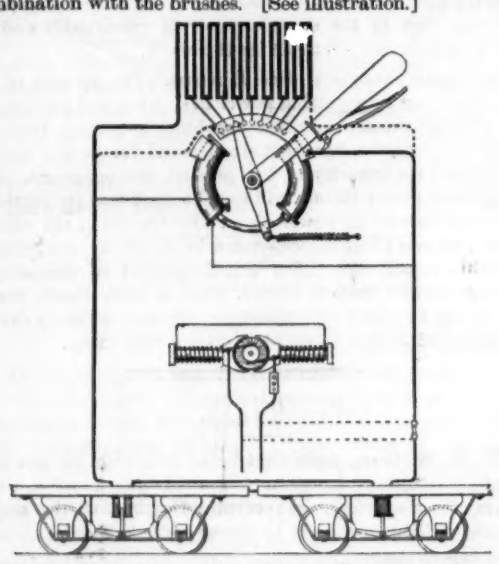
356,756. Alarm for the Protection of Graves; W. H. Farnham, Minneapolis, and C. B. Askew, St. Paul, Minn. Application filed March 22, 1886. Circuits are run from a grave or tomb to the sexton's quarters or other proper place, where it is connected with a signal for giving the alarm when the grave or tomb is tampered with.

(1) 356,786. (2) 356,788. Electric Arc Lamp; H. L. Pyle, Akron, Ohio. These inventions both relate to "focusing" lamps, and to the particular devices for regulating the arc, and maintaining it at a fixed point in space.

356,792. Electric Signal for Engines; J. C. Ricketson, Milwaukee, Wis. Application filed Oct. 14, 1886. Devices are employed for indicating at any point distant from an engine or its shaft the direction in which the latter is revolving.

(1) 356,795. Terminal for Incandescent Lamps; **(2) 356,796. Contact Piece for Electrical Apparatus**; M. M. M. Slattery, Woburn, Mass., Assignor to the Sun Electric Light Co., of same place. Applications filed respectively Oct. 25, 1884, and July 30, 1885. (1) A terminal consisting of a flat strip of metal divided into smaller strips or strands integral therewith. (2) A cross-head is arranged between two spring plates. By turning the head, contact is either made or broken between the springs.

356,834. Electric Motor; W. W. Griscom, Haverford College, Pa. Application filed Aug. 25, 1885. This invention embraces improvements in the form and construction of the field-magnet and the disposition of its coils with respect to the armature, an improved armature core, and a cut-out switch in combination with the brushes. [See illustration.]



356,964. METHOD OF OPERATING ELECTRIC BRAKE.

356,850. Electrical Call System; J. D. Peachey, Denver, Col. Application filed Oct. 1, 1886. The combination of main lines through the building connected in open circuit with an annunciator, and local lines proceeding from the various rooms and connected to the main lines, and signals or indicators, each having a spring actuated signal door or arm, a detent to secure the same when closed, and a lever connected with one of the local lines and adapted to simultaneously trip the detent and close the circuit, thereby sounding the annunciator and displaying the signal.

356,859. Multiple Switch-Board System of Telephone Exchanges; E. P. Warner, Chicago, Ill., Assignor to the Western Electric Co., of same place. Application filed Nov. 6, 1886. The invention consists in providing a switching device and connection for each of the different test-circuits, so that on taking up the plug of any line the test circuit or wire of the line will be immediately closed to ground, so that an operator at any other board, on connecting with the said test wire at any other board, will find the circuit and will thus know that the line is busy.

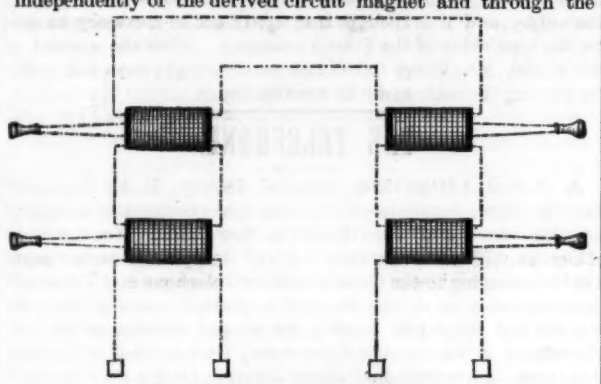
356,875. Fire Extinguishing Apparatus; W. Harkness, New York, N. Y. Application filed May 17, 1886. This invention provides means whereby the water in distributing water pipes in buildings is prevented from entering the pipes until a fire occurs, when the valves are automatically opened and the pipes fed. This prevents leakage of the pipes and consequent damage to goods stored in the buildings.

356,877. Sound-Recording Apparatus; C. J. Hohenstein, New York, N. Y. Application filed Aug. 10, 1886. The inventor provides a concave reflector, which is adapted to bring rays of sunlight to a focus on another reflector, which in turn reflects the focused ray on to sensitized paper. Sound waves impinging against the concaved reflector will cause it to vibrate. These vibrations affect the focused ray and cause it to trace upon the sensitized paper its own movements. The paper is moved with a regular speed, so that the movements of the ray will be recorded in the form of an irregular line, which may be afterward used in any of the well-known ways.

356,878. Electric Motor; E. J. Houston, Philadelphia, Pa., Assignor to the Thomson-Houston Electric Co., of Conn. Application filed Jan. 2, 1884. The objects of this invention are compactness, economy of construction to increase economy of operation and to permit working at high rates of speed without the proportion of energy they develop being considerably reduced.

356,879. Apparatus for Manufacturing Carbons; J. T. Lister, Cleveland, Ohio. Application filed Aug. 30, 1886. The object is to simplify and cheapen the handling of carbons before and after they reach the press. An unbroken track is provided connecting the mold, furnace and press, so that the carbons may be conveniently passed from one to the other.

(1) 356,902. Armature for Dynamo-Electric Machines; **(2) 356,903. Electric Arc Lamp**; Elihu Thomson, New Britain, Conn., Assignor of (1) to the Thomson-Houston Electric Co., of Boston, Mass. Applications filed respectively May 25, 1883, and July 3, 1885. (1) The invention consists of a cylindrical or annular core or carrier for the armature coils composed of one or more helices of iron of any convenient cross section, but preferably made of thin sheet-iron plates or ribbons, set on edge and wound or otherwise formed into a helix concentric with the armature shaft. (2) The main circuit magnet acts to lift the feed mechanism to form the arc independently of the derived circuit magnet and through the

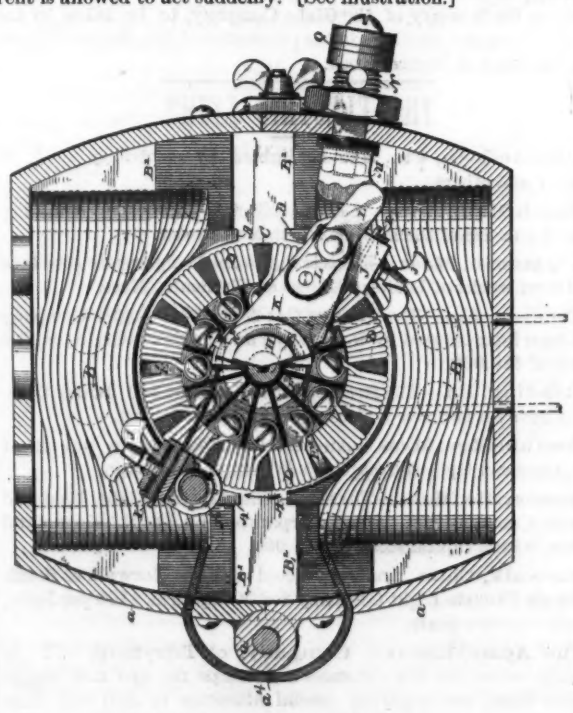


357,134. TELEPHONE SYSTEM.

magnetic influence of parts, one of which is mechanically connected with the feed mechanism, while the other is upon a movable support actuated by the derived circuit magnet, the latter magnet being employed solely to move such support in a direction to cause the magnetically-suspended feed mechanism to be lowered, so as to effect a feed.

356,940. Electrical Weighing Scale; Willis M. Hunt, Glen Gardner, N. J. Application filed April 7, 1886. The first claim sets forth the invention as follows: The combination, with the weighing-scales of an electrical contact maker and breaker, and electro-magnetic valve retaining and releasing mechanism controlled by the scales and contact maker and breaker.

(1) 356,963. Circuit Closing Apparatus for Electric Brakes and other Devices; **(2) 356,964. Method of Operating Electric Brakes**; E. E. Ries, Baltimore, Md., Assignor, by direct and mesne assignments, to Edw. O. Punchard, of Boston, Mass. Application filed Nov. 4, 1885. The object of these inventions is to regulate the amount of current which passes to the brake apparatus, thus preventing excessive wear on the parts which occurs when the full force of the current is allowed to act suddenly. [See illustration.]



356,834. ELECTRIC MOTOR.

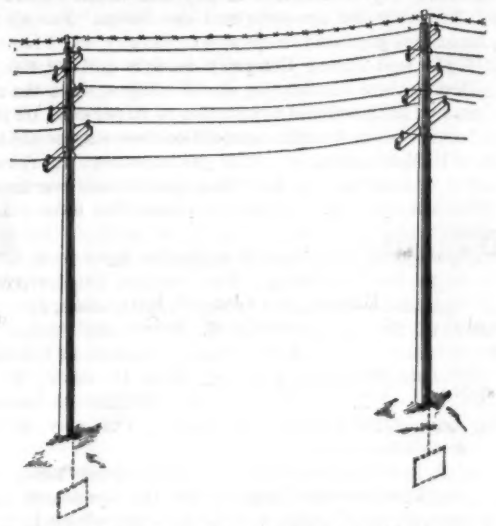
356,981. Insulating Underground Electrical Conductors; D. Brooks, Philadelphia, Pa. Application filed July 19, 1886. After the wires have been drawn through the conduit, a liquid insulating material is poured into the conduit, which soon becomes hard. Any insulating material whose normal condition is solid, but is adapted to soften and become liquid on the application of heat, is suitable for the purpose.

(1) 357,038. (2) 357,039. Autographic Telegraph; J. H. Robertson, Rutherford, N. J. Applications filed respectively Sept. 13 and 15, 1886. (1) Means for, or method of, varying the current which consists in immersing one electrode to a greater or less extent in a liquid constituting part of the electrode. (2) In this case the electrode is not immersed to a greater or less extent, but is located in the liquid and advanced toward or withdrawn from that part of the vessel where connection is made with the conductor.

357,050. Lightning Protector for Electrical Conductors; J. H. Vail, New York, N. Y. Application filed June 2, 1886. A lightning rod in the shape of barbed wire is hung along in close proximity to the regular conductors. The lightning conductor is connected with ground at short intervals by means of low resistance conductors.

(1) 357,051. Automatic Telephone Switch; **(2) 357,052. Telephone Signal**; **(3) 357,053. Telephone Hook**; **(4) 357,054. Krotophone Receiver**; Frank C. Watkins, Philadelphia, Pa., Assignor, by mesne assignments, to the United States Krotophone Company, of New York, N. Y. Applications filed respectively April 27, 28; May 13, and June 26, 1886. (1) The transmitter is provided with a receptacle for the receiver, and has a switch-lever pivoted to its casing, the inner end of which controls the switch and is within the transmitter, and the outer end of which extends into the receiver-receptacle, whereby the removal and replacing of the receiver operates the switch. (2) Means for showing when the telephone is, or is not, in use, consisting of two or more indicator-drops, provided with means whereby one is released when the magnet is energized, and another when the current is broken. (3) A simple arrangement of telephone hook is provided whereby the usual switching of the current in the call circuit is accomplished. (4) A diaphragm and a permanent magnet in connection therewith is provided. The magnet is provided with a helical conductor.

(1) 357,055. Automatic Electric Cut-off for Water Pipes; **(2) 357,056. Electrical Method of Detecting Water Overflows**; Leopold Weil, New York, N. Y. Applications filed June 19, 1886 and Oct. 14, 1886, respectively. (1) A water-absorbing device is constructed to render operative an electrical apparatus, when said device comes in contact with water, and the electrical apparatus is connected with a cock in the water supply pipe of a building and closes the cock. (2) Consists in a method or system of automatically detecting an overflow of water, which comprises means for directing such overflow to an electrical water detecting device, which becomes operative, in the presence of water, to sound an alarm.



357,050. LIGHTNING PROTECTOR FOR ELECTRICAL CONDUCTORS.

357,103. Process of Purifying Carbon; F. H. Snyder, Jersey City, N. J., Assignor of one-third to G. W. Richardson and M. Luscomb, of Boston, Mass. Application filed May 15, 1883. Gas carbon, as it comes from the retorts, is pulverized and then treated by the process of elutriation to separate it into grades of different specific gravity. Each grade may then be used for purposes to which it is particularly adapted, the lightest portion being, the purest, is admirably adapted to be utilized for carbon pencils and filaments.

357,109. Electrical Interlocking Mechanism for Switches and Signals; G. Westinghouse, Jr., Pittsburgh, Pa. Application filed Aug. 7, 1886. The invention consists of certain combinations of fluid-pressure motors for operating switches or some part of or appliance connected with the track, valve mechanism for directing fluid-pressure upon a liquid column at a distant station to operate the motors in either direction, interlocking mechanism for operating the valves of a series or number of such motors in some predetermined order, electrically controlled mechanism for locking the interlocking apparatus at intermediate positions and electric circuits for controlling the intermediate locking mechanism, such circuits being made and broken both in the preliminary movements of the valve mechanism of the motors and also at the completion of their piston stroke, electrically-controlled fluid-pressure mechanism for operating signals, circuits controlling the signal motors, made and broken both individualy and in sets by the interlocking apparatus, and also by movement of the interlocking mechanism, electrically-controlled mechanism for securing the interlocking apparatus in position for operating signals, and electric circuits controlling such locking mechanism, such circuits being made and broken by operation of the signal-motors.

357,115. Commutator Adjuster for Dynamo-Electric Machines; C. L. Buckingham, New York, N. Y. Application filed Aug. 5, 1886. The invention provides means whereby the brushes of a dynamo may be automatically shifted or adjusted to follow any changes or shifting of the neutral line.

357,134. Telephone System. J. O. Stockwell, Burlington, Kas. Application filed March 18, 1886. Induction coils, line circuits and telephonic apparatus are electrically connected in such a manner that one set of acoustic vibration does not interfere with the other set. [See illustration.]

357,165. Automatic Electrical Signal Coupler; J. S. Capers, New Orleans, La. This coupling is adapted to unite the separate sections of an electric circuit extending throughout the length of the train of cars in such manner that the breaking away of any car shall serve to uncouple the separable parts of the connection, and thereby cause an annunciator located in the engine house to give notice of the accident.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.